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UNITED STATES COMMISSION OF FISH AND FISHERIES.

PART XVI.

REPORT

OF

THE COMMISSIONER

FOR

1888.

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1.—REPORT ON THE FISHERIES OF THE PACIFIC COAST OF THE UNITED STATES.

By J. W. Collins.

I.—INTRODUCTION.

1. HISTORY OF THE INVESTIGATION.

Among the matters that specially engaged the attention of the Commissioner, Hon. Marshall McDonald, immediately after his appointment in 1888, and one which was deemed very important, was the prosecution of an inquiry having for its object the collection of statistics and other data relating to the commercial aspects of the river, shore, and sea fisheries of the Pacific coast of the United States, exclusive of Alaska. This was part of a general plan for a thorough investigation of all matters relating to the western fisheries. The *Albatross* had been dispatched to the Pacific the previous autumn for the purpose of making a careful survey of sea fishing grounds and carrying on other scientific researches of importance to the fishery interests. She entered upon her work in the summer of 1888, and it was intended that the inquiry respecting the extent and value of the fisheries, etc., should be prosecuted contemporaneously with the researches at sea. Unforeseen circumstances, however, delayed the immediate inauguration of the inquiry as originally planned.

It was the intention of the Commissioner that I should make a preliminary reconnoissance of the west coast fisheries in the spring and early summer of 1888, and preparation had been made for the trip, when circumstances rendered it necessary for him to order me to Washington to assume more responsible duties.

The organization of the Division of Fisheries, the conduct of important inquiries concerning the fisheries of other regions, and my connection with the exhibit of the Fish Commission at the Centennial Exposition held at Cincinnati in the summer and autumn of 1888, made it entirely impracticable to undertake the investigation of the Pacific fisheries until near the close of the year.

On November 15, 1888, Mr. W. A. Wilcox was assigned to the duty of making the inquiry, and he immediately began work at San Francisco. Later he went to San Diego and, beginning there, traveled north to Puget Sound, visiting nearly all the fishing stations along the coast and on the rivers. In some instances he was able to secure all necessary information for certain regions from parties carrying on the fisheries there, but who were met elsewhere. In these cases no advantage would have accrued from visiting the localities omitted, because they were generally in remote places difficult of access, and since it was then out of the fishing season the canneries were closed; besides, no one else could give such reliable information concerning the fisheries at those points as the parties interviewed. With few exceptions, however, the various fishing centers, rivers, bays, etc., were visited during the height of the season, when the conditions and methods of fishery could be observed under the most favorable auspices.

Many difficulties were encountered in prosecuting the inquiry, and it became necessary to go over much of the region twice. Fisheries situated away from the ordinary lines of communication had to be reached by primitive methods of travel, and the utmost tact was required in some cases to secure necessary information from suspicious Chinese, or others having only an imperfect knowledge of the English language, and whose interest in the fishing industry goes no further than the pittance it supplies them. Though instances of this kind were exceptional, they were occasionally almost insurmountable obstacles to obtaining a full knowledge of the fisheries.

An important phase of this inquiry has been the examination of the commercial fisheries of the small streams, bays, and harbors along the coast, many of which had not previously been investigated.

The canvass made by Mr. Wilcox closed on September 23, 1889, when he was ordered to other duty. Subsequently, during the winter of 1889-90, it became necessary to make some additional inquiry concerning certain details of fishery, etc., at Santa Cruz, San Francisco, and the Sacramento River; the *Albatross* was then lying at Mare Island navy-yard, and Mr. A. B. Alexander, fishery expert on board that vessel, was detailed for the purpose. The notes forwarded by him contained considerable information relative to the fisheries in 1889, which, of course, it was not practicable to secure at an earlier date; this has proved valuable in the compilation of the report. He completed his work on January 7, 1890.

Although the inquiry covered 1889 in part, complete statistics were obtained only for 1888. These figures are given in the tabulated statements, while the statistical data secured for 1889 appear incidentally in the text.

As fishery expert on the *Albatross*, Mr. Alexander made studies of certain phases of the cod fishery prosecuted in Alaskan waters and of the Puget Sound fisheries, to which reference is made elsewhere.

2. SCOPE AND OBJECT OF THE REPORT.

The scope of this report is limited to a consideration of such fisheries as are prosecuted in or from the region embraced between the southern extremity of California and the northwestern limit of Washington. Incidentally, a somewhat extended reference has been made to certain phases of fishery in Alaska, in explanation of industries controlled by capitalists of San Francisco or elsewhere, and which really constitute a part of the fishing interests of the region specially treated of here. Mention has also been made of the Alaskan salmon fishery in order that the statistics of the Pacific fisheries may be as comprehensive as practicable, and that intelligent comparisons may be made of the relative productiveness of the various localities in the territory controlled by the United States.

An investigation of the salmon fisheries of Alaska was made by Dr. Tarleton H. Bean, ichthyologist of the Commission, in the summer of 1889, and a report has been prepared and published giving the results of the inquiry.

A leading object has been to make this a geographical review, so far as practicable, and the attempt has been made to localize the fisheries of each section, so that their relation to other industries and all other local conditions affecting them may be understood. An important phase of this part of the work has been the consideration of the commercial fisheries of the small streams and bays, most of which have not been previously mentioned in the reports, for the reason that many of them have attained prominence as fishing centers since any similar inquiry was undertaken. A scarcely secondary object has been to embody all leading facts concerning the history, methods, statistics, etc., of each of the more important branches of the fishery industry. Another important feature is the attempt to point out how certain fisheries may be improved or new enterprises established. Thus the knowledge gained of the conditions of the fisheries of the west coast makes it feasible to suggest, from a study of similar industries elsewhere, what should be done to secure the best results.

For lack of space it has been found impracticable to put in this report a chapter on fishing vessels and boats prepared for that purpose; that will, however, be published hereafter. For the same reason some other important matters have not been sufficiently elaborated. However, nothing vitally important to a proper presentation of the matters dealt with has been omitted.

3. SOURCES OF INFORMATION.

The chief source of information has been the inquiry prosecuted by Messrs. Wilcox and Alexander, in which the latter took only a comparatively small part. It is, however, only just to say that important studies were made by Mr. Alexander of the northwest-coast fisheries, which have been embodied in the report made by Captain Tanner on the explorations of the *Albatross*. This report has been drawn upon for data relating to fishery methods.

The writings of Rathbun, Elliott, Bean, Jordan, and Gilbert have been valuable sources of information both as relates to methods and the definition and distribution of species. In a very few cases interesting and valuable data have been obtained through correspondence.

Through the courtesy of the transportation agencies, fish-packers, and fish-dealers, the agents of the Commission were generally able to get full and reliable data from the records of firms, corporations, etc.

4. METHODS OF TREATMENT.

In preparing this report an effort has been made to present all the useful information in the most convenient shape for reference. In some cases the fishing interests of a locality were so insignifiant that they have been disposed of in a single chapter; but in most instances the material has been arranged and classified to show all the important details. The method of treatment has been varied by necessity, so as to adapt the consideration of fisheries to existing conditions of a geographical or local nature. In California, where there are coast fisheries, it has generally been feasible to consider their relations to the various counties bordering the sea and bays. Exception to this occurs in the discussion of the fisheries of the Sacramento and San Joaquin Rivers.

The fisheries of Oregon and Washington, however, are largely confined to streams of greater or less magnitude, and the most desirable method has been to consider each river basin by itself, regardless of territorial limits. The region embracing Puget Sound, Washington Sound, the Strait of Juan de Fuca, and the Gulf of Georgia has been discussed as if it were a river basin.

The report begins in the south at San Diego, where the inquiry practically started, and each geographical section is taken in turn until the northern extremity of the coast line of Washington is reached.

Perhaps the most important matter connected with the treatment of available information relates to illustration. The maps herewith presented for the first time will prove a valuable aid in conveying a proper understanding of the fishery industries of each section, showing the fishing grounds, the location of special forms of fixed apparatus, fishing towns, canneries, etc. Other illustrations show the methods of fishing, the fishing stations, the preparation of products, etc.

5. IMPORTANCE OF THE PACIFIC FISHERIES.

The fisheries of the Pacific coast of the United States are second only in rank to those prosecuted along the Atlantic coast; several branches take precedence of all others of a similar character in the world, while others are now coming into marked prominence or have much that is promising for the future.

Among the first may be mentioned the fur-seal and salmon industries, which are unequaled elsewhere. The whale fishery has attained important proportions, and San Francisco may now fairly be considered the leading center of the whaling industry. The canning of sardines on an extensive scale, the preparation of caviare, the establishment of a mackerel fishery, an improvement in the cod fishery as the result of demand in South American markets, and an increase in the fresh-salmon trade, are important probabilities which may be fully realized within a comparatively short time if the proper effort is made to profit by existing conditions and to utilize available resources.

There has been a gratifying increase in the fisheries of the Pacific, taken as a whole, since the census of them was obtained in 1879–80, and there is reason for anticipating future advancement in certain directions, though cause exists for serious apprehension of decline in the fur-seal fishery, and possibly in one or two other branches, if present methods continue.

In illustration of the important position held by the west coast in contributing to the world's food supply, the appended tables, relating to the salmon-canning industry, may with propriety be introduced here. For purposes of comparison, and that the entire industry may be placed before the reader, the results of the business in Alaska and British Columbia are added to those of the Pacific States.

An outline of the salmon canning in 1889 is given in the following table, from which it appears that of 122 canneries in operation that year, 98 were in United States territory and 24 on British soil, and of the former 36 were in Alaska. Of the total pack, Alaska produced the largest part; and, although in the number of canneries that Territory exceeded Oregon by only one establishment, the output was more than double that of the State named, a fact due partly to the larger capacity of the Alaskan canneries, but chiefly to the greater productiveness of the Alaskan rivers.

Abstract of the salmon-canning industry of the Pacific coast of North America in 1889.

Locality.	No. of canneries.	No. of cases of salmon canned.	Value at average market price.
Alaska	36	675, 000	$3, 375, 000
British Columbia	24	414, 400	2, 072, 000
Washington	18	292, 000	1, 201, 240
Oregon	35	328, 113	1, 965, 267
California	9	73, 847	452, 082
Total	122	1, 701, 460	9, 065, 609

The pack of the west coast during the fourteen years ending 1889, as shown by the following table, amounted to 12,493,086 cases, with an estimated value of about $75,000,000. The weight of the salmon consumed in the preparation of this enormous pack was over 876,000,000 pounds, equivalent in point of weight to 1,000,000 head of cattle, and greatly exceeding the latter in economic importance and food value.

Annual output of the salmon canning industry of the Pacific coast of North America from 1876 to 1889.

Year.	Cases.	Approximate gross weight of fresh salmon utilized.
	Number.	*Pounds.*
1876	475,000	33,250,000
1877	[illegible]	[illegible]
1878	638,000	44,660,000
1879	[illegible]	37,772,000
1880	679,500	47,565,000
1881	911,160	[illegible]
1882	994,800	69,636,000
1883	1,106,600	77,462,000
1884	985,295	68,970,650
1885	863,715	60,460,050
1886	[illegible]	65,324,790
1887	997,890	69,852,300
1888	1,189,372	83,256,040
1889	1,701,460	119,102,200
Total	[illegible]	876,416,920

Although of only about 7 years' existence, the salmon-canning industry of Alaska has become more important than that of any other region. The increase in growth during the past few years has been phenomenal, especially in 1889, when the pack of 675,000 cases represented an increase of 377,000 cases over the previous year. How long the supply of salmon can keep up under this enormous drain can not be predicted, but it would seem that in any event Alaska is to be the great salmon region of the future. The yearly increase is shown in the table:

The Alaska salmon pack from 1883 to 1889.

Year.	Number of cases.	Year.	Number of cases.
1883	36,000	1887	190,200
1884	45,000	1888	298,000
1885	74,850	1889	675,000
1886	120,700		

The importance of British Columbia as a salmon-producing and salmon-canning country may be seen in the following summary, covering 14 years. As in Alaska, there was a large increase in the output in 1889, independently of an increase in the number of canneries.

Number of salmon canneries in operation in British Columbia from 1876 to 1889, and the annual output of canned salmon.

Year.	No. of canneries.	No. of cases canned.	Year.	No. of canneries.	No. of cases canned.
1876	3	9,847	1883	24	196,292
1877	8	67,387	1884	[illegible]	141,242
1878	10	113,601	1885	[illegible]	108,517
1879	9	61,093	1886	17	161,264
1880	9	61,849	1887	20	204,083
1881	12	177,276	1888	21	184,040
1882	18	255,061	1889	24	414,294

An examination of the table exhibiting the extent of the export and shipping trade in canned salmon shows that more than one-half of the total pack in 1889 was sold in Europe, and about one-fifth of the pack was consigned to the Eastern States. The entire export trade of British Columbia is with the mother country, to which the Columbia River also sends all that portion of the pack not shipped to points in the United States. San Francisco likewise has a large trade with England; it also exports considerable quantities of canned salmon to Australia and makes smaller shipments to numerous other countries.

It will be noticed that the record of shipments falls considerably below the total amount packed. This is due chiefly to the fact that account has only been taken of the important shipments to the Eastern States, while the local consumption of Canada and other British provinces, as well as that of the Western States, has not been included. The main object of this table is to show the general drift of the Pacific coast trade in canned salmon.

Shipments of canned salmon by rail and water in 1889.

Whence and where sent.	No. of cases shipped by rail.	No. of cases exported by vessels.	Total.
British Columbia:			
To London	....	175,843	175,843
To Liverpool	....	157,686	157,686
Total	....	333,529	333,529
Columbia River:			
To London	....	36,605	36,605
To Liverpool	....	100,885	100,885
To Eastern States	212,757	....	212,757
Total	212,757	137,490	350,247
San Francisco:*			
To Australia	....	80,141	80,141
To London	....	85,064	85,064
To Liverpool	....	258,031	258,031
To Hamburg	....	500	500
To the Orient	....	3,308	3,308
To Pacific islands	....	4,191	4,191
To Spanish America	....	1,031	1,031
To Eastern States	110,498	41,753	152,251
Total	110,498	470,123	580,621
Grand total	323,255	941,142	1,264,397

*So far as could be ascertained the following localities were represented to the extent given in the exports of canned salmon from San Francisco to European ports: Alaska, 268,676 cases; Columbia River, 9,374 cases; Sacramento River, 15,026 cases; other United States rivers, 22,436 cases; British Columbia, 40,140 cases; unknown, 42,861 cases.

6. REMARKS ON FISHING GROUNDS, ETC.

As a rule the location, designation, outline, and description of the shore fishing grounds, including those in bays and rivers, have been based on information furnished by the fishermen who daily work upon them, or by others familiar with the facts. In many cases, however, it was practicable for the agents of the Commission to visit the fishing grounds, more particularly those on the bays and rivers, and from actual observation to mark definitely on the charts the location and extent of fishing areas. At the same time the leading characteristics of the different localities were noted, including the kinds and quantities of various species of fish or other aquatic animals that occur in each section in different seasons. The notes on the distant sea fishing grounds have been compiled from various sources, most of the information, however, being the result of investigation by the U. S. Fish Commission.

In a large majority of cases no attempt has been made to define the limits and contour of the fishing grounds, except to show the areas actually utilized by the fishermen. In the greater number of instances the regions off the coast thus marked are smaller in extent than would appear from actual surveys, taking a certain depth as a basis of limitation. In a few cases, notably about the Farallone Islands, the area said to be frequented by the fishermen is larger than might be supposed if one were guided only by the relative depth of water. Those familiar with fisheries will readily comprehend how these apparent discrepancies must appear when the object is simply and only to show approximately those regions which are commercially important as fish-producing areas. It is confidently believed that all fishing grounds of commercial importance have been shown which come within the scope of the maps. Care has been taken to designate the extent and location of all areas where oysters, clams, and other valuable mollusks occur in considerable abundance.

A specially important feature is the location and designation of fixed apparatus, such as pound nets, weirs, traps, fish-wheels, etc., on the coast and in the rivers and bays, besides which the seine-reaches have been defined, and in many other ways the apparatus chiefly used on certain fishing grounds has been shown.

7. ARTIFICIAL PROPAGATION AND ACCLIMATIZATION.*

No section of the country is probably more dependent on fish-culture for the successful continuance of its fisheries than the Pacific slope. Experience has fully demonstrated that the supply of salmon is likely to be so much reduced through overfishing that the industry depending upon their capture must soon be abandoned, unless the skill and well-directed efforts of man are utilized to maintain the stock upon which he draws so heavily and so continuously. Artificial propagation of fish has now passed beyond the experimental stage, and there is no longer doubt in unprejudiced and well-informed minds as to its possibilities when conducted intelligently and on a scale equal to the objects aimed at. It is believed by those competent to speak on the subject that the artificial propagation of salmon has been very beneficial of late on the Columbia River, although the hatchery on the Clackamas has not been long established and the magnitude of its operations has not, until quite recently, been commensurate with the important interests at stake.

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*While the results of artificial propagation of food-fishes on the west coast and the introduction of Atlantic species in the waters thereof are subjects germane to the objects of this review, the space allotted precludes extensive discussion here. It is intended, however, to fully discuss this work in an article on the results of artificial propagation which the Commissioner now has in contemplation.

One of the best illustrations of the effect of fish-culture in the waters of the west coast is found at Rogue River. Here, for several years, the proprietor of the fishery at Ellensburgh, Mr. R. D. Hume, has been accustomed to have a private hatchery. Salmon were kept in confinement until ready to spawn, when their eggs were taken and treated essentially as they are handled at other hatcheries. Every year more or less fry were put into the river. This has resulted in a continuous and gratifying increase in the abundance of salmon in the Rogue River from the first season when the effect of artificial propagation was observed, which was about four years after fry were first hatched out at Ellensburgh. Thus the pack of canned salmon on this river has been more than doubled in a few years, due entirely to the increase in the abundance of fish. The supposition is that salmon would have continued to grow scarce in the river, as was observed before artificial fish-hatching was resorted to, until the supply became so much reduced that packing them would no longer have been profitable. It is a remarkable fact that Rogue River is the only stream on the Pacific slope which has shown an increase in the number of salmon entering it; a result, however, that has only been noticeable since artificial propagation was begun there.

The acclimatization or introduction of certain species into Pacific coast waters has been a most important matter. Among those so introduced are the shad (*Clupea sapidissima*) and striped bass (*Roccus lineatus*), two of the most delicious food species of the Atlantic region, and both anadromous. The shad is now widely distributed along the coast, and promises to become abundant in time. It is reputed to have changed its habits somewhat on the west coast because of local conditions; instead of returning to the sea as soon as it has spawned in the rivers, as is its habit in eastern waters, some observers say it seldom enters the ocean, or at least does not go far, because of the cold waters of the Humboldt stream that sweep in along the coast; it remains in the warmer waters of the estuaries and bays, and is taken at nearly all seasons.

The striped bass is beginning to figure conspicuously in the markets; the newspapers occasionally notice the capture of large specimens, and there is reason to anticipate that it will attain prominence in time.

The carp has increased greatly in numbers, and is a very common species in San Francisco and some other places.

Among the recent efforts of the United States Fish Commission to introduce new species into Western waters has been the attempt to plant the Atlantic lobster (*Homarus americanus*) in the Pacific. This proved completely successful. In 1888 565 adult lobsters and 104,000 fry were planted off the coast in localities deemed most suitable for them. What the result of this will be can be conjectured, but can not be definitely determined until after the lapse of sufficient time to give the lobsters an opportunity to grow and multiply.*

8. COMPARISON OF THE FISHERIES OF THE PACIFIC STATES.

There is considerable variation in the fishing interests of the three Pacific Coast States both as relates to their character and their value. In order that the opportunity may be presented for an easy comparison of their respective importance the following tables are produced here:

Persons employed in the fisheries of the Pacific States in 1888.

States.	Fishermen.		Shoresmen and factory hands.	Total.
	On vessels.	On boats.		
California	*1,543	3,088	667	5,298
Oregon	53	2,945	1,524	4,522
Washington	283	2,571	976	3,830
Total	1,879	8,604	3,167	13,650

* Not including 753 men employed on whaling vessels belonging at New Bedford, Massachusetts, and making their headquarters at San Francisco.

Apparatus and capital employed in the fisheries of the Pacific States in 1888.

States.	Apparatus of capture.											
	Gill nets.		Seines.		Trammel nets.		Trap nets, pound nets, and weirs.		Salmon wheels.		Value of minor apparatus.	Total Value.
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.		
California	2,367	$258,465	1,640	$57,625	329	$14,735	.....	....	.....	....	$25,850	$317,175
Oregon	1,545	322,620	25	7,200	.....	....	56	$41,550	24	$63,622	2,900	437,943
Washington	1,130	187,345	50	44,240	.....	....	159	122,400	15	45,287	2,945	402,177
Total	5,042	768,430	1,715	109,065	329	14,735	215	163,950	39	108,909	31,[illegible]	1,157,295

States.	Vessels.				Boats.		Other property.		Total capital invested.
	No.	Net tonnage.	Value.	Value of outfit.	No.	Value.	Value of wharves, buildings, and accessories.	Cash capital.	
California	94	12,108.31	$1,046,200	$447,475	1,354	$245,010	$322,050	$307,500	$5,094,210
Oregon	13	422.30	74,950	11,400	1,545	201,065	619,294	922,850	2,296,032
Washington	17	702.75	71,000	32,520	1,202	145,520	334,220	533,000	1,517,397
Total	124	13,233.36	1,192,150	491,395	4,101	591,595	1,275,564	1,763,350	8,908,239

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* For a detailed history of the transplanting of lobsters to Pacific waters, reference is made to a paper by Mr. Richard Rathbun, in the Bulletin of the U. S. Fish Commission, vol. VIII, 1888, p. 453.

Products of the fisheries of the Pacific States in 1888.

Species.	California.		Oregon.		Washington.		Total.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Fish.								
Salmon, fresh * ...lbs.	5,024,[illegible]	$[illegible]	23,415,242	$[illegible],016	10,186,[illegible]	[illegible]	47,[illegible],112	$2,087,730
Salmon, pickled. lbs	515,000	18,660	582,900	21,505	133,900	4,986	1,181,800	45,050
Shad, fresh ......lbs	96,871	6,512	10,000	500	200	50	101,071	7,062
Other fish, fresh. lbs	9,785,729	543,458	1,008,970	29,[illegible]	2,294,400	95,345	13,[illegible]	[illegible]
Other fish, pickled and dried ......lbs.	4,947,[illegible]	180,442	201,290	4,474	290,000	10,100	5,448,[illegible]	145,016
Total	23,312,334	1,081,306	25,109,206	1,018,848	12,914,330	783,108	57,[illegible]	2,[illegible],240
Mammals.								
Fur seal, sea otter, walrus, hair seal, and sea lion pelts............No.	†107,812	1,709,644	....	....	5,281	32,900	113,094	1,[illegible],548
Ivory and whalebone ....lbs.	197,000	365,[illegible]	....	....	....	....	197,000	[illegible]
Whale and seal oil ....galls.	232,290	104,834	....	....	....	....	232,290	104,834
Total	....	2,180,373	....	....	....	32,900	....	2,[illegible],281
Mollusks and crustaceans.								
Oysters .....bushels	130,000	513,175	4,125	6,229	60,[illegible]	86,574	195,115	601,[illegible]
Other mollusks .lbs.	6,246,325	170,480	561,000	7,225	300,000	3,200	7,107,325	181,005
Crabs, shrimp, crayfish, and prawn .lbs	5,363,430	176,882	1,194	710	6,875	1,070	5,371,480	180,[illegible]
Total	....	860,538	....	14,291	....	90,844	....	971,673
Miscellaneous.								
Reptiles, fish oil, fertilizer, caviare, etc.	....	15,000	....	8,440	....	4,000	....	27,[illegible]
Grand total	....	4,[illegible]	....	1,0[illegible],574	....	880,[illegible]	....	6,[illegible]

* Including those subsequently canned.

† These include the fur-seal skins taken at the Pribilof Islands, in Bering Sea, which are a product of a fishery carried on by San Francisco capital.

Summary of the salmon-canning industry of the Pacific States in 1888.

States.	No. of canneries.	No. of factory hands.	Salmon used for canning.		Canned salmon placed on market.	
			Pounds.	Price paid to fishermen.	Cases.	Value.
California	5	360	4,[illegible]	$215,[illegible]	74,[illegible]	$464,[illegible]
Oregon	34	1,584	21,[illegible]	[illegible],773	[illegible]	1,[illegible],617
Washington	21	976	15,[illegible]	647,772	226,[illegible]	1,[illegible]
Total............	60	2,[illegible]	41,[illegible]	1,732,[illegible]	622,[illegible]	3,[illegible]

9. COMPARISONS WITH 1880.

One of the most interesting and instructive results of the systematic collection of fishery statistics is the institution of comparisons whereby the relative status of these industries in past and present years may be intelligently considered, and the changes noted, whether for better or worse. For the purpose of presenting in as compact form as possible the comparative statistics for 1880 and 1888, the following tables have been prepared. These show at a glance the changes between those two periods.

*Comparative tables for the years 1880 and 1888, showing the extent of the fisheries of the Pacific States.**

1. PERSONS EMPLOYED.

States.	Fishermen.		Shoresmen.		Total.	
	1880.	1888.	1880.	1888.	1880.	1888.
California	2,089	4,731	1,005	607	3,094	[illegible]
Oregon	2,795	3,006	4,040	1,584	6,835	[illegible]
Washington	729	2,654	15	976	744	[illegible]
Total	5,613	10,[illegible]	5,060	3,167	10,673	12,[illegible]

2. APPARATUS AND CAPITAL.

States.	Vessels.				Value of apparatus and outfit.		Cash capital and value of shore property.	
	No.		Value.					
	1880.	1888.	1880.	1888.	1880.	1888.	1880.	1888.
California	49	94	$535,350	$1,046,500	$205,840	$802,150	$307,000	$590,550
Oregon		13		74,050	245,780	440,343	639,000	1,372,144
Washington	7	17	11,100	71,600	8,648	443,697	4,000	666,220
Total	56	124	546,450	1,192,150	460,268	1,686,190	950,000	2,628,914

States.	Boats.				Total investment.	
	No.		Value.			
	1880.	1888.	1880.	1888.	1880.	1888.
California	853	1,354	$91,485	$245,010	$1,139,675	$2,684,210
Oregon	1,360	1,545	246,600	201,005	1,131,380	2,286,652
Washington	334	1,202	6,610	145,980	30,253	1,517,367
Total	2,547	4,101	344,695	591,995	2,301,308	6,488,229

3. RESULTS OF THE FISHERIES.

States.	Fish.			
	1880.		1888.	
	Pounds.	Value.	Pounds.	Value.
California	24,577,930	$750,961	23,313,324	$1,001,368
Oregon	39,500,000	855,302	25,160,266	1,010,843
Washington	5,707,000	96,520	19,014,336	703,108
Total	69,784,930	1,702,783	67,578,926	2,965,349

States.	Value of whale, walrus, seal, and sea-otter products.		Value of crustaceans and mollusks.		Value of other miscellaneous products.		Total value of fishery products.	
	1880.	1888.	1880.	1888.	1880.	1888.	1880.	1888.
California	$2,[illegible]	$2,490,573	$194,000	$[illegible]	$3,500	$15,460	$[illegible]	$4,462,[illegible]
Oregon	4,200			14,281	10,000	8,440	865,602	1,033,574
Washington	55,012	32,668	10,000	93,344	2,500	4,000	167,032	890,068
Total	2,258,112	2,523,241	204,000	371,672	16,000	27,900	4,776,[illegible]	6,387,[illegible]

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* It would appear that the figures for Washington for 1880, taken from the *Fisheries and Fishery Industries of the United States*, section II, do not include the fisheries of that Territory prosecuted on the Columbia River. It is probable that the entire fishery industry of that river has been credited to Oregon, which fact should be borne in mind in noting comparisons between 1880 and 1888.

† Including the fur-seal and sea-otter fisheries of Alaska that are prosecuted by California capital.

10. SUGGESTIONS.

In studying the various phases of the west coast fisheries, and having in mind the condition, methods, etc., of similar industries elsewhere, it seems proper to offer some suggestions which may prove timely and helpful. In taking this action I am not insensible to the responsibility incurred, nor is there lack of appreciation of the disadvantage I labor under in not having had the opportunity to personally inspect the condition of the Pacific fisheries. Nevertheless, it seems eminently desirable that attention should be called to the following matters:

Improvements in fishing vessels and boats.—In no other direction, perhaps, can certain fisheries be benefited to a greater extent than by the introduction of improved types of vessels and boats. Small, properly rigged auxiliary steam vessels of suitable model can be much more advantageously used than sailing craft in many of the fisheries on the Pacific. It is true that small steam schooners are now employed, but the schooner rig seems rather unhandy for a steamer, and from all the information obtainable the form of these vessels is not the best that could be devised.

In no other branch of the fisheries is a change in vessels and boats apparently so much needed as in the market fishery. Reference is made to this in discussing the market fishery of San Francisco and other places farther south. There is a general need of the adoption of welled boats, in which fish, crustaceans, etc., can be kept alive until they are brought to market, and the day may not be far distant when welled steamers may be profitably employed. In a country where ice is scarce and costly, it is especially important that every improvement should be utilized which will result in placing fish products upon the market in the best possible condition at the least expenditure. The use of steam smacks is not exactly an experiment, since vessels of this description are now employed to bring fares of live halibut from Iceland to England. Perhaps the time has not yet arrived when the demand for fresh fish in Pacific ports is sufficient to warrant the employment of steam welled vessels, but it is well known that sailing smacks can be used without any increase of expenditure, while the advantage of being able to offer live fish for sale might be very great.

The mackerel fishery.—At present there seems to be an opportunity for the establishment of a mackerel fishery on the coast of California south of Monterey. There is a remarkable consensus of statement as to the moderate abundance of the bull's-eye mackerel (*Scomber colias*) along the California coast, and it would seem to be entirely feasible to make catches with comparatively small outlay for vessels and equipment. The common mackerel (*S. scombrus*) is now exceptionally scarce in the western Atlantic and perhaps may not be abundant for a series of years. In the meantime, the demand for salt mackerel is partially supplied by importations from foreign countries, and large quantities of fresh fish of this species are also brought from

Canada at considerable expense. It is therefore important that this demand should be supplied, so far as practicable, by the products of American fisheries.

If the proper methods are adopted, it may be feasible to bring quantities of the bull's-eye mackerel from the west coast to the markets of the Central States, and even as far as the Atlantic coast. A profitable business might be inaugurated by canning mackerel in this region if the supply is sufficient to warrant the attempt and the quality of the fish is suitable for packing in this manner.

Atka mackerel.—The Atka mackerel, or yellow-fish (*Pleurogrammus monopterygius*), occurs in considerable numbers in the western part of the Aleutian archipelago, about Atka and Attu Islands, during May, June, and July. Usually it arrives about the middle of May and remains until toward the latter part of July. It is said that this is a most delicious species, and would be a very excellent substitute for the common mackerel. It is also believed that it may be readily taken in considerable numbers by hook-and-line fishing. The natives secure considerable quantities in the season, by spearing.

Mr. L. M. Turner, who visited Atka Island in 1879, found that fish of this species arrived "in countless thousands" about the 18th of June. He says that they generally head the tide, which rushes with great velocity through the pass, the fish varying their position as the current changes. He observed that the spawning season is generally over as early as the 20th of July, after which the fish gradually disperse and return to the deeper waters of the Pacific.

The following remarks by Mr. Turner are from his "Contributions to the Natural History of Alaska":

> The fish arrive at Attu, from the southwestward, about the 24th of April, though this date varies according to the openness of the season. It is rarely later than the 1st of May. The fish come at first in a straggling manner, and their first appearance is made known by their being caught on hooks while the men are fishing for other kinds. The first-comers are usually adult males. They are not fat on arrival, but soon become so from the abundance of small crustaceans that fairly swarm among the patches of seaweed by the 10th of May, and at which time the fish are tolerably numerous. By the 10th of June thousands of these fish can be seen in the shallow water (about 1½ to 8 fathoms deep) below. The natives here take considerable quantities of these fish, and dry them for use at an early date. * * * When they go to catch them they visit the various localities known to be the haunts of these fish, and by looking beneath the mass of kelp fronds can see them if present; if not, the fish are off in the open water.
>
> * * * * * * *
>
> I here had opportunity to come to the conclusion that these fish will bite readily at the hook. I saw them jump and struggle to get at the gaff and could feel them strike against it while it was in the water, and at times it was impossible to hold it in position, as the mass of moving fish carried it along with them. Any kind of fresh fish may be used as bait on a small cod-hook for these fish. A piece of scarlet flannel tied above the hook is good to attract the fish, as they will then bite voraciously. With the hook a person can catch the fish as fast as put into the water. With the use of several hooks on one line several fish may be taken at once. With the gaff the fish are taken in great quantities, equal to all demands. The run lasts at Attu until July 25, after which the fish are spent and slowly disappear from the water.

> These fish were not known at Attu previous to 1875. They came unexpectedly and were caught on hooks set for other fish. Since that time the people have had an abundance of them. From my own observations I am led to assert that 500 barrels of 200 pounds each can be procured at Attu in the season from June 1 to July 31.[*] At the entrance to Chicagof Harbor is the only known locality at Attu where these fish resort. These fish are also reported to be abundant at Kiska Island, between the islands of Atka and Athákh; also between Unálga and Unalaska, and also in the passes between some of the Shumagin Islands. I saw a few individuals in Captain's Harbor, Unalaska Island, in the early part of July, 1881. This is the first instance of their occurrence in that locality. * * * They can be prepared at a cost of $2 per barrel for the fish at either Attu or Amlia. The cost of the barrel and salt, of course, is to be added. Only the necessary sheds for protecting the barrels from the weather would have to be erected. Native help could be procured at a cost of $1 per day for a man, and 50 to 75 cents per day for the women, who can clean the fish as expertly as the men. Ere many years these fish will command a highly remunerative price to those who will engage in the enterprise.

It is a matter of regret that no well-directed effort has been made by white men to capture this species in quantities by hook and line. In the summer of 1889 Captain Jacobs reported that he went to Atka in the schooner *Mollie Adams* and made a special effort to catch the yellow-fish by the use of a purse seine. The habit of the species, however, which impels it to frequent shallow water, particularly where the giant kelp grows in abundance, rendered nugatory all attempts to catch it by seining. I am not informed that he made any endeavor to secure it by fishing with hook and line.

Freezing-houses.—The importance to the fishing interests on the Pacific coast of the establishment of properly constructed freezing-houses can hardly be overestimated. The demand for fresh fish in all parts of the country is a growing one, and apparently increases more rapidly than the population. This demand should be met and all legitimate means should be employed to increase it. Among the methods so far adopted for the preservation and distribution of fishery products, none perhaps has met with greater or more deserved favor than that of artificially freezing many species of fish which can be satisfactorily kept in this manner and distributed through the means of refrigerator cars over an enormous extent of territory. In the matter of supplying the demand for salmon, the Pacific region unquestionably has an advantage, and one that it is believed will be maintained if all available resources are utilized. It will doubtless be found that a greater amount of money will be realized if a larger percentage of the products of the salmon fishery can be disposed of in a fresh condition instead of being canned. And this additional advantage will accrue: that the quantity of salmon consumed will be much larger than heretofore, which must manifestly be to the profit of the producer.

It is probable that freezing-houses might be profitably utilized to advance the demand for and distribution of many species of fish besides those belonging to the salmon family. Allusion has been made, in the body of the report, to what has been accomplished on the Columbia River in the case of the sturgeon, and there seems to be no good reason why similar results may not be attained in other directions.

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[*] The statement that 500 barrels of Atka mackerel could be taken at Attu in a single season, probably refers to what Mr. Turner believes might be secured from the natives.

Halibut may some time become an important factor in the fresh-fish trade of the west coast; and it is worth while to call attention to the fact that this species can not be successfully handled in a frozen state. It might prove advantageous to have the means of keeping it in a temperature a trifle above freezing, but when frozen its flesh becomes so flabby and flavorless as to render it practically unfit for food.

Artificial ice.—The difficulty of obtaining natural ice throughout the region embraced within the scope of this report, namely, from San Diego to Puget Sound, is a serious drawback upon the market fishery. As it is entirely feasible at present to manufacture ice at a moderate cost, plants for this purpose should be established at a few of the fishing centers along the coast. This is an enterprise in which the fishing interest itself should be concerned, that it may not be subjected to overcharges for ice. The extent of the market fishery and market trade of San Francisco would seem to warrant the establishment of a plant capable of furnishing all the ice required in the fish trade of that city, and perhaps even to supply fishing stations near it. Astoria, Portland, and Seattle would seem to be other points where the manufacture of ice may be made profitable.

Canning of halibut.—It seems possible that canned halibut might be introduced in the markets of the United States or other countries. In view of the comparative cheapness of the raw material on Puget Sound, it might be worth while for parties interested in canneries there to pack a few cases, in order to introduce this article of food in the markets of the world.

Markets for cod, etc.—In the chapter on the cod fishery, attention has been called to the possibility of establishing new markets in South American countries, and also to the feasibility of curing cod in a special manner for exportation. It is not necessary to discuss this matter at length here, but simply to refer to suggestions made elsewhere.

Handling market fish.—No matter connected with the fishery of the west coast seems to demand more earnest attention than the subject of properly caring for and distributing fresh-fish products. Attention has been called to this in the chapter on the market fishery of San Francisco, and the remarks made there are believed to be equally applicable to many places on the Pacific, where fish are sold in a fresh condition. There can be no question that it will be to the advantage of producers and consumers alike if the most improved methods are adopted and the most intelligent care is exercised in the matter of marketing the products sold for daily consumption. It seems pertinent to say that nothing improves the quality of fish more than to kill them by a blow immediately after they are caught, and, if practicable, to bleed them. This method can be very readily applied to fish of any considerable size, and it will add immensely to the firmness of flesh and its flavor as an article of food.

Utilization of waste products.—There seems to be an opportunity in some of the larger fishery centers to profitably utilize the waste products, and thus add considerably to the returns now obtained from fishing. In the discussion on the Columbia River fisheries, mention is made of a small establishment at Astoria which has handled waste products to a limited extent; much more might be done in that direction on the Columbia River, and considerable quantities of material might be utilized at San Francisco which are now thrown away. A ready demand could be found in farming communities for all fertilizers manufactured from waste products of the fisheries. Large quantities of sturgeon and other fishes are now thrown into the Columbia River, to decay and to pollute the waters, which ought to be applied to food purposes or in some other way for the benefit of mankind. This matter deserves the earnest consideration of all interested in fishing; for whatever the conditions may be to-day, the time is not far distant when the results of such wasteful destruction will be too apparent.

Transportation, etc.—The question of transportation is important, and may well engage the consideration of all having the welfare of the fisheries at heart. It appears that while the transportation agencies of the West, as a rule, are disposed to deal fairly with shippers of fish, it is nevertheless true that freight charges are a serious burden and may limit the distribution of perishable products. The value of the fish trade to the prosperity of the railroads is doubtless understood, but the full importance may not be realized. It is probable, however, that the intelligence which controls transportation agencies will lead to the adoption of a fairly liberal policy, and that concessions will be made to the advantage of the fishing interests, which will promote their increase and development.

Under the head of the halibut fishery of Puget Sound, reference has been made to the advantages that might be secured by having centers of distribution in the great cities of the Central States. It may be to the advantage of the transportation interests, as well as the fisheries, to aid in securing the facilities referred to.

The importance of the fish trade to the development of transportation facilities has been exemplified in many instances and in various countries. In England the important city of Grimsby, at the mouth of the Humber River, has been practically built up to its present magnitude through the efforts of a railroad company, which built docks for the accommodation of fishing fleets, and found its return in carrying the products to markets.

II. ACKNOWLEDGMENTS.

I take pleasure in acknowledging courtesies and assistance received from the following parties:

The U. S. Coast and Geodetic Survey has furnished charts upon which annotations of fishing grounds, etc., were made, and which served as a basis for the maps accompanying this report.

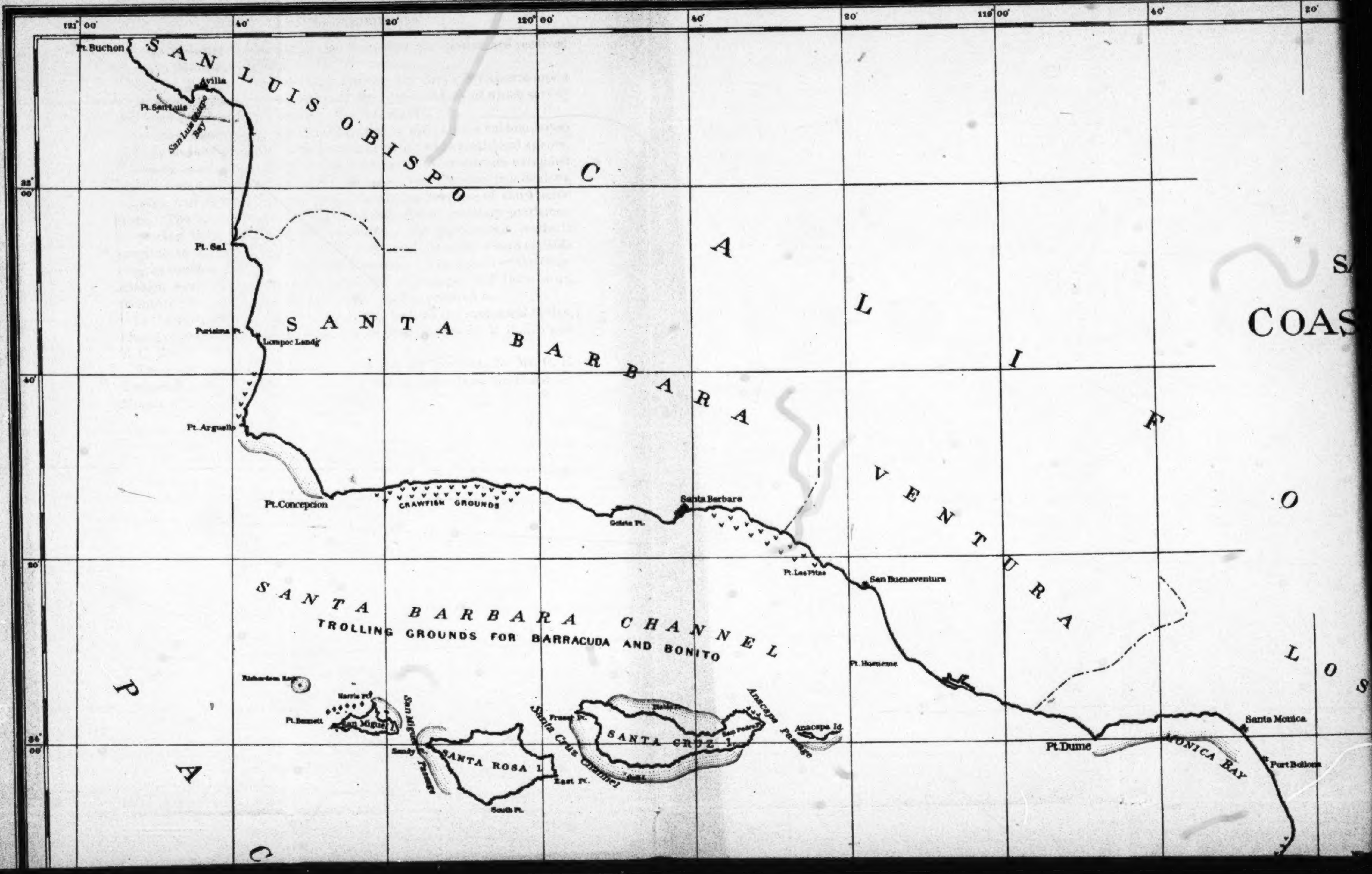
The Fish Commission is under obligation to the various custom-house officials on the Pacific coast for courtesies rendered to statistical agents.

I desire to acknowledge in an especial manner the courtesies extended to Fish Commission officials by the transportation agencies, fish-dealers, canners, and others connected with the fishing business of the Pacific slope. The intelligent, appreciative interest shown by many gentlemen in placing their records at the disposal of the Commission made it possible to obtain accurate data in numerous instances where reliable returns could not otherwise have been secured. The agents of the Commission were frequently transported free of charge, and their work facilitated by the generous action of the parties referred to.

In the preparation of the report, particularly of the statistical tables, I have received much valuable assistance from Messrs. H. M. Smith and E. C. Bryan.

The maps have mostly been made, under my direction, by Mr. C. E. Gorham; the other drawings for illustration have been prepared by Messrs. C. B. Hudson and A. H. Baldwin.

Report U. S. F. C. 1888.—(To face page 21.) Pacific Coast Fisheries.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Pt. San Luis
San Luis Obispo Bay
Pt. Sal
Purisima Pt.
Lompoc Landg
Pt. Arguello
Pt. Concepcion
CRAWFISH GROUNDS
Goleta Pt.
Santa Barbara
Pt. Las Pitas
San Buenaventura
Pt. Hueneme
Pt. Dume
Santa Monica
MONICA BAY
Port Ballona
SANTA BARBARA CHANNEL
TROLLING GROUNDS FOR BARRACUDA AND BONITO
Richardson Rock
Harris Pt.
Pt. Bennett
San Miguel I.
San Miguel Passage
Sandy Pt.
SANTA ROSA I.
East Pt.
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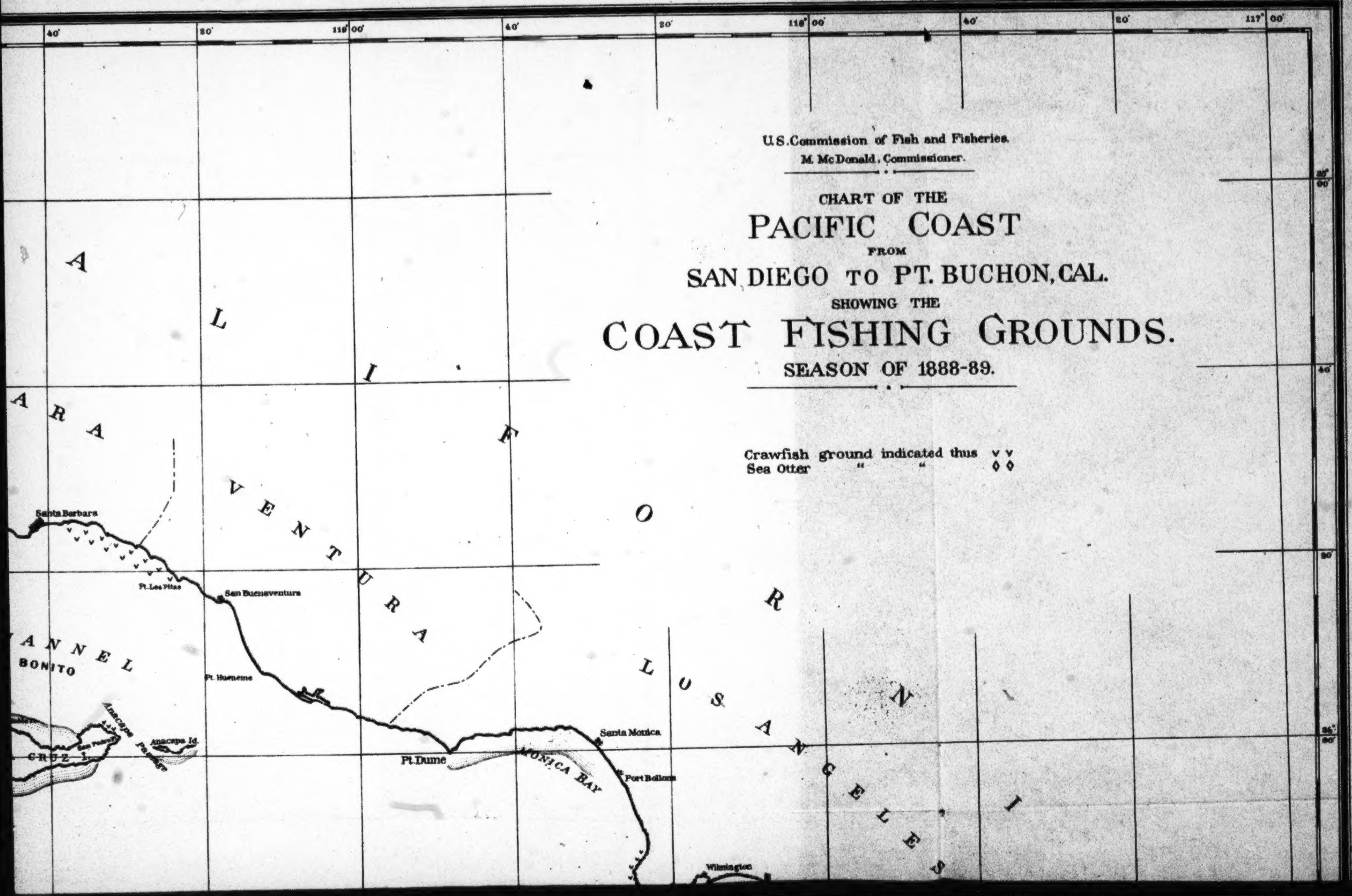
Santa Cruz Channel
Fraser Pt.
SANTA CRUZ I.
San Pedro Pt.
Anacapa Passage
Anacapa Id.

PLATE I.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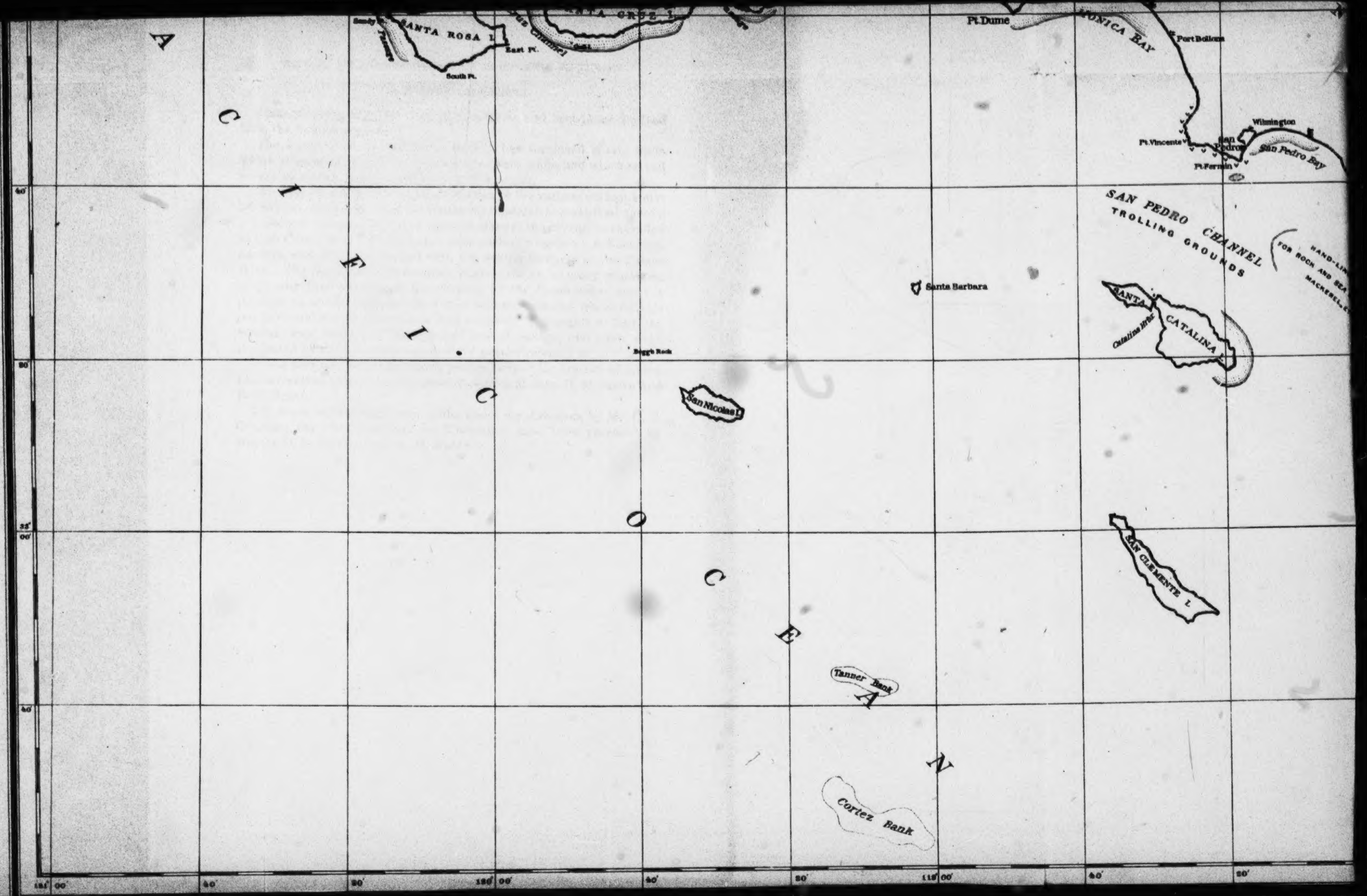
San Pedro
CRUZ I.
Pt. Dume
Monica Bay
Santa Monica
Port Ballona
Wilmington

U.S. Commission of Fish and Fisheries.
M. McDonald, Commissioner.

CHART OF THE
PACIFIC COAST
FROM
SAN DIEGO TO PT. BUCHON, CAL.
SHOWING THE
COAST FISHING GROUNDS.
SEASON OF 1888-89.

Crawfish ground indicated thus v v
Sea Otter " " ◊ ◊


A C I F I C O C E A N
SANTA ROSA I.
Sandy
East Pt.
South Pt.
SANTA CRUZ I.
Pt. Dume
MONICA BAY
Port Ballona
Wilmington
Pt. Vincente
San Pedro
San Pedro Bay
Pt. Fermin
SAN PEDRO CHANNEL
TROLLING GROUNDS
HAND-LI…
FOR ROCK AND SEA…
MACKEREL…
Santa Barbara
SANTA CATALINA
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Begg Rock
San Nicolas I.
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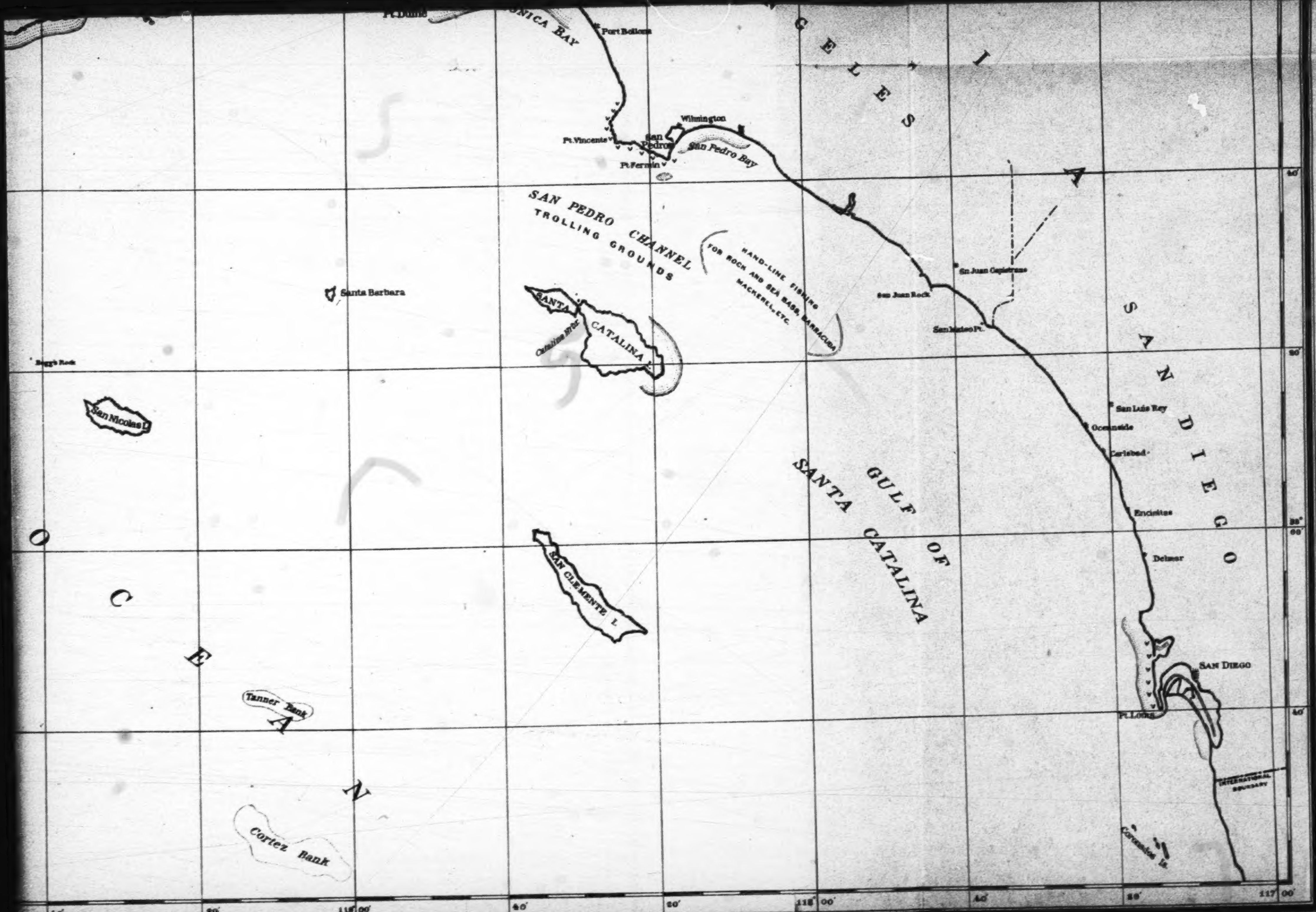
Pt. Dume
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Wilmington
San Pedro
Pt. Vincente
Pt. Fermin
San Pedro Bay
SAN PEDRO CHANNEL
TROLLING GROUNDS
HAND-LINE FISHING
FOR ROCK AND SEA BASS, BARRACUDA
MACKEREL, ETC.
Santa Barbara
SANTA
CATALINA
Catalina Harbor
Begg's Rock
San Nicolas I.
Sn Juan Capistrano
San Juan Rock
San Mateo Pt.
SAN DIEGO
San Luis Rey
Oceanside
Carlsbad
Encinitas
Delmar
GULF OF
SANTA CATALINA
SAN CLEMENTE I.
O C E A N
Tanner Bank
Cortez Bank
SAN DIEGO
Pt. Loma
INTERNATIONAL BOUNDARY
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II.—THE FISHERIES OF CALIFORNIA.

12. GENERAL REMARKS.

The fisheries prosecuted from California surpass in importance those of any other Pacific State, and in many branches rank among the foremost in the country. The vessel fisheries are particularly important, those for fur seals, sea otters, walruses, and whales being of greater extent than those of any other State. Salmon fishing is largely carried on in California, but to a less extent than in Oregon and Washington. The other market and food-fish fisheries carried on from small boats and the shore are also of great importance.

The following tabular statements, covering the year 1888, show in detail, by counties, the number and nationality of persons engaged in the fisheries; the number and value of vessels, boats, and apparatus employed; the value of shore property; the amount of cash capital; and the quantity and value of products taken:

Table of persons employed in the fisheries of California in 1888.

Locality.	Fishermen.		Shoresmen and factorymen.	Total.
	Vessel.	Shore.		
San Diego County	88	71		159
Los Angeles County		137		137
Santa Barbara County		15		15
San Luis Obispo County		25	2	27
Monterey County	4	123		127
Santa Cruz County		25		25
San Francisco Bay and vicinity*	†1,451	1,122	730	3,303
Sacramento and San Joaquin Rivers		1,282	295	1,577
Humboldt County		288	11	299
Del Norte County		70	43	113
Total	1,543	3,168	[illegible]	5,[illegible]

*Including San Francisco, San Pablo, and Suisun Bays, and the counties of San Mateo, San Francisco, Santa Clara, Alameda, Contra Costa, Solano, Sonoma, and Marin.

† Not including 753 men employed on whaling vessels belonging at New Bedford, Massachusetts, and making their headquarters at San Francisco.

Nativity and nationality of persons employed in the fisheries of California in 1888.

Country.	Nativity.	Nationality.	Country.	Nativity.	Nationality.
United States	806	1,726	Austria	10	18
United States (Indians)	68	69	Russia	107	75
Mexico	4	4	Spain	50	46
Central America	3	2	Portugal	641	487
South America	16	16	Italy	768	916
Great Britain	226	186	Greece	32	28
France	16	14	China	994	994
Germany	165	160	Japan	20	20
Belgium	1	1	Sandwich Islands	15	12
Holland	3	3	South Sea Islands	14	12
Sweden	413	226	Total	4,731	4,731
Norway	129	121			
Denmark	21	15			

This table does not include shoresmen.

Table of apparatus and capital employed in the fisheries of California in 1888.

Locality.	Apparatus of capture.									
	Gill nets.			Trammel nets.		Seines.		Traps, pots, and fykes.		Value of hand lines, trawl lines, etc.
	No.	Length (feet).	Value.	No.	Value.	No.	Value.	No.	Value.	
San Diego County	20	5,000	$825	......	......	5	$1,000	60	$90	$300
Los Angeles County	73	18,250	2,150	......	......	12	1,625	140	210	830
Santa Barbara County	21	5,800	720	14	$560	3	300	60	120	77
San Luis Obispo County	40	12,000	2,000	......	......	......	......	......	......	925
Monterey County	80	19,000	2,400	......	......	20	3,065	......	......	853
Santa Cruz County	110	26,400	4,400	......	......	6	750	......	......	910
San Francisco Bay and vicinity	1,332	426,400	80,720	315	14,175	1,563	44,275	1,200	3,300	17,955
Sacramento and San Joaquin Rivers	504	756,000	151,200	......	......	......	......	30	700	......
Humboldt County	127	54,600	7,350	......	......	16	4,800	......	......	......
Del Norte County	60	16,000	5,000	......	......	2	300	......	......	......
Total	2,367	1,413,450	256,465	329	14,735	1,629	57,635	1,490	4,420	21,430

Locality.	Vessels and boats.						Other property.		Total capital invested.
	Vessels.				Boats.		Value of wharves, buildings, accessories, and land.	Working capital.	
	No.	Net tonnage.	Value.	Value of outfit.	No.	Value.			
San Diego County	22	277.16	$13,200	$7,200	43	$6,010	$1,000	......	$32,825
Los Angeles County	......	......	......	......	60	10,510	500	......	15,855
Santa Barbara County	......	......	......	......	24	2,375	300	......	4,482
San Luis Obispo County	......	......	......	......	19	2,500	200	......	5,625
Monterey County	1	11.00	600	100	50	8,975	500	......	17,273
Santa Cruz County	......	......	......	......	20	10,900	450	......	17,410
San Francisco Bay and vicinity	71	11,820.65	1,032,500	440,075	477	96,030	106,000	$155,000	1,980,030
Sacramento and San Joaquin Rivers	......	......	......	......	520	100,800	200,000	100,000	552,700
Humboldt County	......	......	......	......	93	1,860	1,500	2,500	18,010
Del Norte County	......	......	......	......	84	2,150	13,600	10,000	31,050
Total	94	12,108.81	1,046,300	447,475	1,354	245,010	323,050	267,500	2,684,210

Table of products of the fisheries of California in 1888.

Locality.	Fish.									
	Fresh salmon.		Fresh shad.		Other fresh fish.		Pickled salmon and dried fish.		Total.	
	Lbs.	Value.	Lbs.	Value	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
San Diego Co	......	......	......	......	630,000	$18,900	530,220	$21,200	1,160,220	$40,100
Los Angeles Co	......	......	......	......	862,588	33,140	100,000	5,000	962,588	38,140
Santa Barbara Co	......	......	......	......	90,320	4,516	6,325	316	96,645	4,832
San Luis Obispo Co	......	......	......	......	129,427	3,663	10,000	800	139,427	4,463
Monterey Co	5,000	$250	......	......	946,326	47,310	51,147	1,557	1,002,473	49,123
Santa Cruz Co	15,000	750	20,000	$1,400	200,247	9,612	......	......	235,247	11,762
San Francisco Bay and vicinity	428,000	30,290	14,000	1,120	6,282,554	402,473	4,250,000	101,700	10,974,554	535,583
Sacramento and San Joaquin Rivers	6,174,978	308,748	66,471	3,963	591,514	20,942	120,000	6,000	6,942,963	339,644
Humboldt Co	747,200	18,394	400	40	61,500	2,675	315,000	9,450	1,124,100	30,559
Del Norte Co	663,857	22,982	......	......	......	......	66,000	3,300	729,857	27,188
Total	8,034,085	382,225	99,471	6,513	9,735,726	543,456	5,462,692	149,062	23,313,224	1,081,256

Table of products of the fisheries of California in 1888—Continued.

Locality.	Mollusks.								
	Oysters.		Clams and mussels.		Abalone shells and meats.		Octopus and squid.		Total value
	Bushels.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	
San Diego Co			20,000	$936	940,000	$20,750			$21,686
Santa Barbara Co					53,825	2,291			2,291
San Luis Obispo Co			10,000	900	1,240	20			920
Monterey Co					10,855	515	230,000	$12,500	13,015
San Francisco Bay and vicinity	130,000	$500,175	2,294,415	75,248	2,000,000	55,000	14,000	1,120	631,543
Humboldt Co			72,000	1,200					1,200
Total	130,000	500,175	2,396,415	78,284	3,005,920	78,576	244,000	13,620	670,655

Locality.	Crustaceans.								Terrapins and frogs.	
	Crayfish.		Crabs.		Shrimp and prawn.		Total.			
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	No.	Value.
San Diego Co	26,400	$1,274					26,400	$1,274		
Los Angeles Co.	150,400	3,761					150,400	3,761		
Santa Barbara Co	19,200	960					19,200	960		
San Francisco Bay and vicinity	25,000	2,000	230,000	$37,200	4,902,360	$141,088	5,157,360	180,288	51,600	$12,900
Sacramento and San Joaquin Rivers									8,400	2,100
Total	221,000	7,995	230,000	37,200	4,902,360	141,088	5,353,360	186,283	60,000	15,000

Locality.	Mammals.									Grand total value of fishery products.
	Skins of hair seal, fur seal,* sea lion, and walrus.		Pelts of sea otter.		Whalebone and ivory.		Whale and seal oil.		Total value.	
	No.	Value.	No.	Value.	Lbs.	Value.	Gals.	Value.		
San Diego Co										[illegible]
Los Angeles Co.	667	$1,050	25	$2,500			500	$110	$3,660	41,961
Santa Barbara Co.							6,750	2,340	2,340	11,743
San Luis Obispo Co										7,748
Monterey Co.										[illegible]
Santa Cruz Co										11,783
San Francisco Bay and vicinity	104,576	1,360,935	2,646	215,150	197,000	$805,904	294,950	102,384	2,484,373	3,654,207
Sacramento and San Joaquin Rivers										[illegible]
Humboldt Co										[illegible]
Del Norte Co										[illegible]
Total	105,243	1,361,985	2,671	217,650	197,000	805,904	302,200	104,834	2,490,373	[illegible]

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*The figures given under this caption include the number and value of fur-seal skins taken at the Pribilof Islands, in Bering Sea, which are a product of a fishery carried on by San Francisco capital. In 1888 the full limit of 100,000 skins was obtained at these islands, the value of which, as laid down at London, where they were sold, was estimated to be $1,650,000. In addition to the foregoing, the fur-seal industry of the Commander Islands (which belong to Russia) was controlled by American capital and the product was brought to San Francisco. In 1888 this amounted to 47,362 skins of fur seals, having a value of $544,063 at the average price paid in London. Combining these figures we have as the total yield of the fur-seal industry in 1888, 151,817 pelts, valued at $2,121,[illegible].

Statistics of the salmon-canning industry of California in 1888.

Location of canneries.	No. of canneries.	No. of factory hands.	Salmon used for canning.		Canned salmon placed on market.	
			Pounds.	Price paid to fishermen.	Cases.	Value.
San Francisco	*2	33	453,700	$22,685	6,875	$41,250
Sacramento River	4	235	4,039,200	201,960	61,200	382,500
Klamath River	1	12	288,200	14,410	4,400	26,400
Smith River	1	20	152,555	6,628	2,347	14,082
Total	8	300	4,933,655	245,683	74,822	464,232

*These two canneries are not engaged exclusively in canning salmon, but are also devoted to fruit canning. In the item of factory hands the figures represent the proportional number of men who were employed in connection with the packing of salmon.

13. FISHERIES OF SAN DIEGO COUNTY.

Geographical characteristics.—This is the southernmost county of the United States on the Pacific coast. Its coast line has a moderate curve and extends in a northwesterly direction (nearly NNW.) from the Mexican boundary to Point Saint Mateo, a distance of about 57 geographical miles. Its shores are characterized by a fringe of beaches extending into the sea for some distance, while above them are generally steep, craggy headlands of sandstone, usually rising a little distance from the surf line. At varying distances from the shore, within 5 miles, is a ridge of stony bottom covered with kelp (*Macrocystis pyrifera*); in the bays where patches of kelp occur it is called "clam kelp" by the local fishermen.

Along this stretch of coast San Diego Bay is the only harbor suitable for important fishing operations, and the only landlocked harbor on the coast of California south of San Francisco, from which it is distant 450 miles in a SSE. direction, being only 12 miles north of the Mexican border. The claim is made that this is the best harbor on the Pacific coast; it is not so large, of course, as San Francisco Bay, but surpasses it in climate and security. It is 13 miles long, has a total area of 25 square miles, and an available anchorage ground of 6 square miles, while the average width of the channel is nearly one-half mile. It will therefore be seen that so far as harbor facilities are concerned San Diego has all the natural advantages requisite for the establishment and maintenance of important fisheries.

Immediately north of San Diego is False Bay, which is barred and so shallow at its entrance that it will not admit anything larger than a small boat; therefore it is not adapted to the purposes of an extensive fishery. North of False Bay the coast is practically unbroken, with the exception of one or two small streams that empty into the Pacific.

San Diego as a fishing center.—The fisheries of San Diego County center in the city of San Diego, situated on the bay of that name. Notwithstanding many important natural advantages, this place remained until recently an insignificant coast settlement, during all the years since it was originally founded as a Franciscan mission in 1769. Its development has been quite remarkable since 1880, due to the establishment of railroad communication and the reputation which the city has attained as a health resort. In the last census year (1880) its population was only 2,637, but in recent years (1887–89) it has been estimated at 30,000 and upwards, though these estimates may have varied somewhat from the actual facts.

With the growth of the population and improvement in facilities for transportation it naturally followed there would be an increase in the local demand for fishery products and consequent improvement in the fisheries. The change in the fishing population since 1880 has been noticeable, not only in the increased number but also because Americans and Europeans constitute a much larger percentage than at that time, when the industry was controlled almost entirely by the Chinese.

The fisheries.—The fisheries of San Diego are of three distinct classes: The offshore vessel fishery, the junk fishery prosecuted by the Chinese, and the inshore fishery carried on in boats of less than 5 tons burden which are not documented. The development of the fisheries of San Diego has largely resulted from the increase of wealth and population in the city and surrounding country. The demand for fish has improved with the growth of the place, and the local supply has often not been adequate to meet it. With the continued advancement of the section, with improvements in vessels, methods, and facilities for shipment, new fishing grounds may be resorted to and larger quantities of fish taken and utilized.

Species, abundance, seasons, etc.—The species chiefly sought in this region are barracuda (*Sphyræna argentea*); bonito (*Sarda chilensis*), commonly known among the local fishermen as the "Spanish mackerel"; eel; flounders, commonly called "halibut"; mackerel (*Scomber colias*); herring (*Clupea mirabilis*); sardine (*Clupea sagax*); jewfish (*Stereolepis gigas*), locally known as the "sea bass"; mullet (*Mugil mexicanus*); rock-cod or "rockfish" (numerous species of *Sebastichthys*); sea bass (*Serranus clathratus*); smelt (*Atherinopsis californiensis* and *A. affinis*); and yellow-tail (*Seriola dorsalis*).

Of the two species of smelt, *A. californiensis* is locally known as the "bottom smelt" and is the most abundant and one of the most important of the food-fishes during the winter and spring. The other (*A. affinis*), called the "top smelt," occurs in San Diego Bay throughout the year. It is said to be abundant, but not so highly prized as the other.

There are several other varieties which are caught in smaller quantities or are less highly valued as food-fish. Among these may be mentioned the lady-fish (*Albula vulpes*); anchovies (*Stolephorus*), of which there are three species that are extensively caught and dried by the Chinese, one of which (*S. ringens*) will perhaps in time become an important species for canning; and the Spanish mackerel. The pompano is occasionally taken in seines and is also caught from the wharves. The China croaker, common croaker, and the yellow-fin are all common and fairly abundant, both in San Diego and False Bays. Two species of so-called sea trout (*Cynoscion nobile* and *C. parvipinne*) are found in the bay in summer and are frequently brought into the market.

There are said to be eleven species of perches or surf-fish (*Embiotocidæ*) about San Diego. They are coarse, cheap fish, and comparatively unimportant, though very abundant and generally brought into the market every day.

Whitefish (*Caulolatilus princeps*) is a valuable species which is taken outside, but in comparatively small quantities.

The food-fishes of San Diego County are said to be much scarcer than in former years, and so far as certain species are concerned the decrease is attributed to the use of very small-meshed nets operated by the Chinese. A writer in the San Diego Union, of February 6, 1889, says:

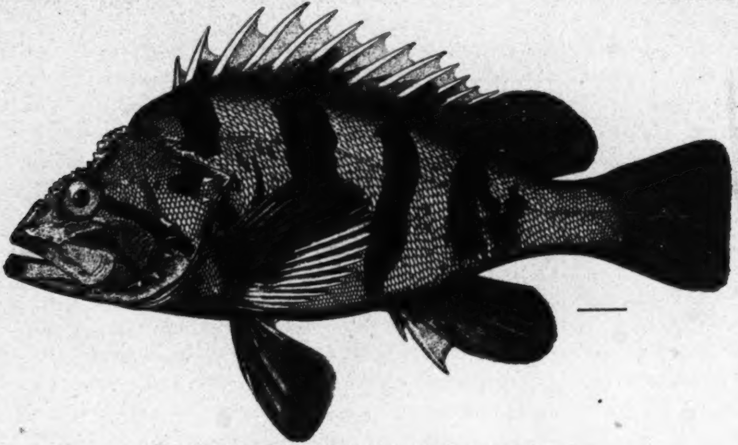
> Something should be done to put a stop to the wholesale destruction of fish by the Chinese, for on the schools thus destroyed depends the supply of edible fish. Fish enter the inlet chiefly for food, and when food is scarce few will come. * * * It is a sorry thing to see small fish by the bushels heaped together on the sands * * * and left to become food for the gulls. To empty them out into the water again does not save them, as their frail life is extinguished by being caught at all. No net of such fine mesh should be permitted.

The bonito was very abundant in 1888, but the barracuda, which is also a migratory species, is said to be yearly decreasing. The former comes to the fishing grounds off this part of the coast in August and leaves in November or December, while the barracuda arrives in March or April and stays until late autumn, generally disappearing about a month earlier than the bonito.

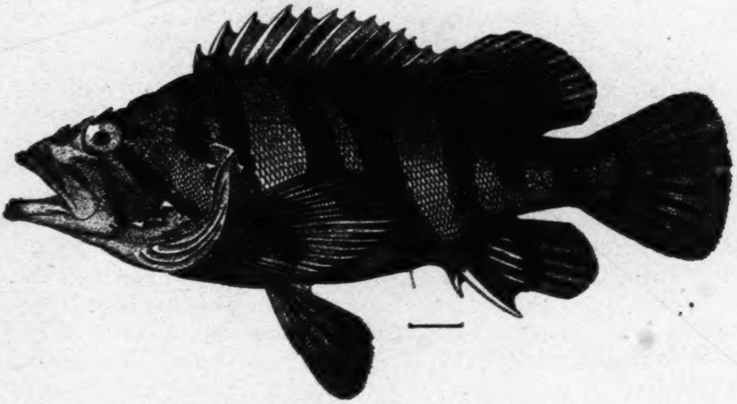
The following notes on the barracuda and the fishery for it at San Diego were written by Prof. Carl H. Eigenmann, and have been extracted from *Zoe* for April, 1890:

> The barracuda (*Sphyræna argentea*) is one of the most important of California food-fishes. It is a long, slender, spindle-shaped, sharp-snouted fish, evidently well calculated to swim rapidly. In summer it is abundant on the whole coast of California from San Francisco southward, but it is probably more abundant southward than in the neighborhood of San Francisco. During the winter it disappears from the coast of California, but is taken on the coast of Lower California. It probably migrates bodily southward, but stray individuals undoubtedly remain in the waters of southern California throughout the year, for 2 or 3 days of exceptionally fine weather invariably bring them into the market. It is likely that these stray individuals live in deep water during the winter and come to the surface on bright days. It is quite possible, though not probable, that a great part of those disappearing descend to deeper water. The fact that they are taken only by the troll or by gill nets sufficiently explains why they should not be caught in deep water.
>
> Their movements have been watched through an entire season at San Diego, and, as these observations may be valuable to serve as a basis of comparison, they may be stated here:
>
> During January, 1890, none were seen. During February, 1890, four were taken on the 7th, one on the 11th, and two on the 28th. All these dates were at the end of a

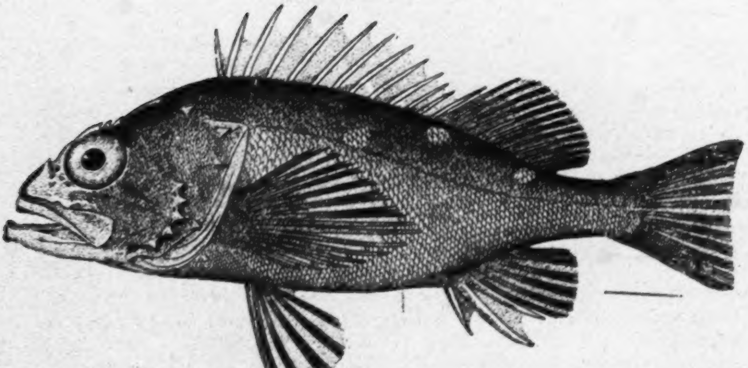
PLATE II.



Black-banded Rockfish (*Sebastichthys nigrocinctus*).



Tree-fish (*Sebastichthys serriceps*).



Corsair (*Sebastichthys rosaceus*).

succession of days of exceptionally fine weather. On March 1, 1890, two were taken. On March 26, 1889, a few were caught, and on the following day they were abundant, and remained so, with occasional lapses, throughout the summer. At the beginning of July they were with ripe spawn.

During September few were taken, but on the 29th, 30th, and 31st of October they were again abundant. On November 6 one was taken, on the 7th another, on the 15th one young one was caught with a hook in the bay, and on the 18th another young one was brought from off Point Loma. On the 16th of December one young individual, evidently of the preceding summer's spawn, was taken in the bay, and on the 30th a large one was caught off Point Loma.

The adults never or very rarely enter the bay, but in the spring the young, those not yet a year old and measuring about a foot in length, enter the bay in large schools, and are then destroyed in quantities with seines or Chinese bag-nets.

About San Diego the troll is the only means used in catching them. It is simply a piece of white rag, or more commonly a fragment of bone, to which a hook is lashed. One or more of these is dragged behind a boat made usually after the pattern of the Columbia River salmon boat. The amount of the catch depends largely on the wind. A slack wind, even when barracuda are abundant, brings but few fish. The largest catch reported for a single day is 1,100 by one boat with two men. Rarely more than forty are taken. They average from 6 to 12 pounds and from 2½ to 4 feet in length, and retail at 10 cents apiece. Large numbers are salted and dried.

About Monterey they are taken in gill-nets. In 1890 the first individuals reached Monterey on March 10.

Like most of the surface and shore food-fishes the barracuda feeds chiefly on the anchovy (*Stolephorus ringens*).

The mackerel comes in along this part of the coast in April. Large schools remain for a few weeks and then move north; they return in October or November, but in a few weeks go southward to the Mexican coast, where they are reported as being abundant during the winter months. A few are found off the coast of California throughout the year. Individuals weigh from 1 to 2½ pounds each and average about 1½ pounds. The Pacific mackerel never gets fat and does not improve with the advancing season like the Atlantic species. When salted, it is usually of a dark color and is an inferior article of food, though when fresh it sells readily in the market. Little attention is paid to the mackerel and the fishermen only catch enough to supply the local demand.

Twenty-seven species of *Sebastichthys* occur on the Pacific coast, of which at least twelve are taken by the fishermen of San Diego. The most common forms, omitting the yellow-tail (*S. flavidus*) are *S. miniatus*, *S. caurinus* subsp. *vexillaris*, and *S. ruber*, all of which are distinguished by their red color. There are also *S. mystinus* and *S. melanops*, which are black. Herring and sardines remain in San Diego Bay and its vicinity throughout the year, and large quantities are taken in drift and set gill-nets from March until November. The fishermen occasionally bring in small specimens of the so-called "black-cod" of the northern Pacific (*Anoplopoma fimbria*), which apparently nearly reaches its southern limit of distribution off this part of the coast. Neither sturgeon nor salmon are found in these waters.

Porpoises are plenty in the bay and along the coast and whales are often numerous in the spring and fall, though no attempt is made to capture either. Sea otter and fur seal, once abundant, seem to have been almost exterminated or to have abandoned this locality. This will be apparent when it is stated that, while the result of the fur-seal fishery in 1879 was 2,000 skins, in 1888 only 25 skins were taken. Hair seals are quite numerous, but receive little attention.

Other objects of the fisheries are abalónes (*Haliotis splendens*), clams, and crayfish or rock lobster (*Panulirus interruptus*). The supply of abalone shells has decreased very materially. Clams of a large size, resembling the deep-sea clam of the Atlantic, are abundant on the flats in the bay and are used to a small extent both for food and bait. Scallops are abundant at times and a few are picked up on the flats at low tide, but there is no fishery for them. Edible crabs are very scarce; the small fiddler crab is the only representative of this tribe which occurs abundantly.

Fishermen.—The fishing population of San Diego is very heterogeneous in its character. In 1888, out of a total of 159 fishermen, only 46 were Americans;* the remainder included 52 Chinamen, 27 Portuguese, 6 Italians, 5 Swedes, and 13 of other nationalities. The Chinese have exclusive control of the junk fishery and frequently engage to a greater or less extent in the fisheries of the bay. The Americans and Europeans control the vessel and sailboat fisheries.

THE OFFSHORE FISHERY.

Fishing grounds.—The fishing grounds for bonito and barracuda can not be definitely described. In general, however, they extend along the coast from north of San Diego to a long distance southward, off Mexico. Sometimes, when fish are not found in abundance near the home port, the vessels go from 200 to 300 miles to the southward for fares. In spring a favorite fishing ground for bonito and barracuda is from 6 to 8 miles about SSE. from Coronado Hotel, which is a little over 3 miles eastward of Point Loma. Fishing is also prosecuted from 6 to 8 miles outside of the kelp beds, from Point Loma to False Bay, and gill nets as well as trolls are used in that region to a small extent, more particularly by boat fishermen.

In the winter of 1888–89 the U. S. Fish Commission steamer *Albatross* discovered and made a thorough exploration of Tanner Bank, which lies directly westward of San Diego, about 95 miles distant. This bank is 7 or 8 miles long, and about 2 miles wide. The *Albatross* also made a comprehensive investigation of Cortes Bank, which lies about 12 miles south of Tanner Bank, and has a length of 14 miles and a width of from 3 to 5 miles. These were found to be important fishing grounds, and the establishment of the fact that valuable food species were taken there was a matter of much gratification to the fishermen of San Diego, who anticipated, in consequence, an increase in their operations.

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* Professor Jordan, reporting on the fisheries of San Diego in 1879, says: "All of the fishermen of this county, excepting four Americans and their employés, are Chinamen. Two Americans and assistants are employed in seal-hunting, the rest in gathering kelp, and, in their seasons, bonito and barracuda fishing."

Lieut. Commander Z. L. Tanner, U. S. Navy, who commanded the *Albatross*, reported that he found numerous species of food-fish in great abundance on Cortez Bank, all of which took the hook readily. Among these were fat-heads, whitefish, yellow-tail, rock-cod, four species of red rock-cod, jewfish, cultus-cod, and sea bass.

When informed officially of this abundance of fish "the citizens of San Diego raised a fund for the purpose of chartering and equipping a fishing schooner for making exploring expeditions so as to determine their extent. A number of trips were made in the summer of 1889, and many thousand pounds of fish were taken, fully substantiating the Government report as to the abundance and quality of the fish. * * * No fishermen have as yet gone to the Cortez Bank, though occasionally some of them go as far coastwise to the south. The fact that no fishermen have been at the Cortez Banks is perhaps the reason why so much interest is taken by them in the explorations of the *Albatross*. As an addition to the fishing grounds skirting the coast these banks are of value to San Diego fishermen."*

Vessels.—The vessels employed in the sea fisheries from San Diego, exclusive of the Chinese junks, which will be described elsewhere, are small, ranging from less than 7 tons to between 24 and 25 tons register. In 1888 they numbered 7 schooners and 2 sloops, and had a total tonnage of 136.15 tons. The number varies considerably from year to year. In 1880 and 1881 there were 6 vessels, aggregating 78.61 tons, but in 1882 the number decreased to 3 vessels of 33.03 tons; and to 1 vessel of 9.38 tons in the year 1883. The fleet increased to 5 vessels, of 46.80 tons, in 1884; 7 vessels, of 79.16 tons, in 1885, while the next year saw only 3 vessels, of 28.2 tons, engaged in the fisheries, though in 1887 they again increased to 5 vessels, of 52.90 tons. It will readily be seen that vessels of this description are not suitable for carrying on an extensive fishery, and the fact that they are all tight-bottomed craft renders them poorly fitted for taking to market any fish other than those which are salted, unless caught near the harbor under circumstances specially favorable for reaching port. Elsewhere reference will be made to suggestions advanced by the writer for improvements in fishing craft used from San Diego.

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* San Diego Sun, October 31, 1889. Since the above-quoted statements appeared in the San Diego Sun, and not long after the investigation of the banks by the *Albatross*, a fishing company was formed at San Diego for the purpose of prosecuting voyages to these grounds. Several trips were made, but, according to the best information obtainable, the enterprise was not a financial success. Its failure was largely due to the fact that (notwithstanding the report to the contrary made by the *Albatross*) the enterprise was started on the false assumption that the true cod (*Gadus morrhua*) could be taken in abundance. Other species were plentiful, but the lack of demand made their capture unprofitable.

Apparatus of capture.—The apparatus used for the capture of bonito and barracuda (the principal species sought for by the vessels) consists of a troll line of soft-laid cotton twine about 60 feet long, with a drail from 3 to 4 inches long of bone or iron, and a hook fastened to it. The hook has its barb filed off blunt, so that it will not be difficult to extract it from the fish, and it is fastened to the lower end of the drail with a rivet through the eye and a piece of wire passing around its shank through two holes in the drail. When the fishermen can not get drails they sometimes use an ordinary hook with a piece of rag tied around the shank as a substitute. The bone drail is said to be preferred for barracuda fishing.

Methods of fishing.—When engaged in trolling for barracuda or bonito a vessel moves along under easy sail, and six or eight lines are kept out at one time; no bait is used, as the fish will readily bite at the drails employed for their capture. The method is similar to that adopted on the Atlantic coast for catching bluefish.

The following account of fishing for barracuda at San Diego is from an article written by J. C. Van Hook and published in Forest and Stream of October 31, 1889:

> At daybreak we were drifting past Ballast Point, the entrance to the bay. After floating a mile out into the ocean, assisted occasionally by a "cat's-paw," we concluded to tie up to the kelp and wait for the wind. Here we enjoyed for an hour the continuous up-and-down motion of the heavy ground swell, sometimes throwing out a line as far as possible and pulling it in rapidly to entice the barracuda which were playing around us, but without success. So we * * * waited patiently for the breeze, which is indispensable for barracuda fishing as it is in the Atlantic for that wily corsair, the bluefish. * * * I heard something like the surf breaking on the shore * * * and about 1,500 porpoises were coming toward us in a line, jumping out of the water and looking like big black wheels rolling along. * * * About 9 o'clock a light breeze sprung up, and, cutting loose from the kelp, we began to move slowly over the water, but not fast enough, as Bob said, to put out our lines. In my anxiety to begin the sport I cast out two lines, and very soon we hooked two so-called Spanish mackerel [bonito] of 10 and 12 pounds apiece. * * * Presently the breeze came along, and within half an hour we were sailing at a lively rate, so we adjusted outriggers, one on either side, about in the waist of the boat, with two lines on each. We also trolled one from the stern, making five in all. Just then we met our friends coming home, loaded with sixty-five barracuda, which they had caught by towing and trolling while we were tied up to the kelp. Being thus encouraged, we put everything in readiness and placed in front of the cabin door a fish box 3 by 3 by 3 feet. Bob had the first strike and pulled in his fish, then he hooked and landed another, and a third. As I was beginning to wonder what was the matter with my lines one of them straightened out, and I began to haul in hand over hand. When I was about to lift him out of the water he doubled himself up, and I brought out the bare hook. I repeated this three times. * * * Upon hooking another I pulled in slowly, and when the fish was 2 feet from the boat I threw him up into the air, bringing him over my head and landed him into the box. Then by catching hold of the drail and shaking it the fish came off easily. As I found out, all the drails for barracuda fishing have the barb of the hook filed very blunt, and an inexperienced person might easily lose his fish, while, at the same time, the hook is readily jerked out of the mouth free from the lance-like teeth.

Now the fun commenced in earnest; first one, then two, four, five, are hooked at a time, and rare sport it was to haul them in. For about 5 minutes we had all we could handle, and then for 10 or 15 minutes we would not see a sign of one. Now we are into them again, hauling away for dear life. Sometimes when hauling in one or two they would become entangled with the other lines, and before we could get them in we would have one, two, or three on the remaining lines, and then there was a sad jumble of lines and struggling fish. Occasionally, in attempting to land the fish in the box, we missed it, and they fell down into the bottom of the boat, or our footing would be lost and we were bunched in a slippery mass—fish and all. The sloop was pitching heavily, as half a gale of wind was blowing. Wet from the waist down, we had what you might call a huge time. The drails towed at the surface of the water and we could see nearly every fish that took hold. We caught 68 barracuda and 2 Spanish mackerel—about 425 pounds of fish—filling our box; and with the loss of only one hook. Having all the fish we wanted by 2 p. m., although the biting was as furious as ever, we got under way to save the wind home. The fish were selling at the time for 10 cents each. The favorite haunts of the barracuda are in and along the edge of the kelp. Sometimes they can be seen in a mass, making the water boil with their frantic leaping; there may be 50 out of the water at a time and as many more just disappearing under the surface.

Preparation and disposition of products.—On board the small vessels fish are usually dressed soon after they are caught, and thoroughly salted in kench; on the vessel's return to port the fish are washed and spread on drying flakes, where the barracuda are left for from 2 to 4 days and the bonito from 4 days to a week. So prepared, the fish are dark in color, oily, and have a strong flavor. They are marketed only in San Francisco, whence most of them are exported to China. In addition to the fish taken, these vessels incidentally collect large quantities of abalone shells along the Mexican shores, which form quite an important item in their returns.

Results of the fishery, lay, etc.—The total products of the San Diego vessel fishery in 1888, exclusive of the junk fishery hereafter to be considered, was 225,393 pounds of salt fish, 53,656 pounds of abalone shells, and 35,229 pounds of abalone meats. The owner of the vessel receives one-fifth of her gross stock, or of the catch, and the remainder is divided among the crew, who furnish all the outfit except small boats.

CHINESE JUNK FISHERY.

Fishing grounds.—The Chinese engaged in the junk fishery work chiefly among the islands and along the coast of Mexico, where they gather abalones from the rocks. Abalones were formerly abundant in the vicinity of San Diego Bay, but the local supply has been exhausted. The fishing grounds principally resorted to by the Chinese, therefore, may be said to be off the Mexican coast. The junks, however, often engage in the capture of small fish in the shallow littoral waters near San Diego. The favorite grounds of the Chinese are south of the city near the peninsula called "the island," and also off the mouth of the Sweetwater and La Doronde Rivers. Bartolome Bay, Lower California, is a favorite resort for the junk fishermen.

Chinese boats.—The junks used by the Chinese fishermen of San Diego are mostly built at San Francisco. Since 1880 their number has been 18, aggregating 141.01 tons, with a value of $5,200, and manned by 52 Chinese fishermen. The junks vary from 7 to 15 tons. They carry no papers except an alien certificate, which insures to the crew permission to land upon their return to the city. In addition to their Chinese names, the junks are numbered by the customs officers, and are known to them by their numbers only.

The junks return as seldom as possible, but if they have occasion to visit San Diego, with or without cargo, they report at once to the custom-house and pay a tonnage tax of 83 cents per ton; $1.50 for entering, 67 cents for survey, and 20 cents for a certificate. It is currently reported that, to avoid payment of these customs dues, the junks often transfer their cargoes of abalone shells, meats, etc., to small boats that come out to sea, off San Diego, for this purpose, and to bring supplies.

Apparatus.—The Chinese use large drag nets or seines, called "bag nets" by the American fishermen, because in the bunt, or center, is a large bag-shaped pocket into which the fish find their way. These bag nets vary from 250 to 300 fathoms in length, and the bag or pocket is about 40 feet deep, with a wing extending on each side to a distance of from about 120 to 140 fathoms, and having a depth of 2 fathoms. The wings are 2-inch mesh and the bag ¼-inch mesh. Each junk carries one or more small flat-bottom boats, somewhat resembling the sharpie in form, for the purpose of collecting abalone shells and for other fishing operations.

Methods of fishing, preparation of products, etc.—The catch of the Chinese junks consists chiefly of abalones gathered from the rocky shores along the Mexican coast. The meats are taken from the shells and boiled on shore in rude vats made of sheet iron, and stone or bricks. Both the shells and meats are then packed in sacks containing from 100 to 125 pounds each. On the arrival of a junk her cargo is sold to the dealers, by whom the shells are culled and repacked. The products are then forwarded to San Francisco, whence most of the meats are exported to China and the shells shipped to France.

In the bag-net or drag-seine fishery prosecuted by the Chinese in San Diego Bay and vicinity, the net is run out in shallow water at some distance from the land in localities known to be favorite resorts for certain species of fish. From each wing of the net a line extends to the shore, and it is gradually drawn in by the fishermen until the ends reach the land. The fish inclosed naturally find their way into the bag in the bunt, which is at last drawn on shore with its contents. The mesh of this bag is so small that there is no chance for escape of the smallest fish, and many are taken only an inch or two in length. Sometimes the Chinese fishermen, during the months of March, April, and May, stretch their nets at high tide entirely across a small stream, and at low tide draw them in again filled with smelt, mullet, and other small fish.

These destructive methods of fishing have been the cause of much complaint. State Deputy Fish Commissioner William Kehoe tried to stop this net fishing, and seized the nets of the Chinese, but as late as May, 1889, the legality of the fishery had not been decided, as the matter was then before the courts.

The fish taken by the Chinese are generally salted and dried, and find their way to San Francisco, whence most of them are exported to China.

Products.—The catch of the Chinese junks in 1888 amounted to 75,000 pounds of salted fish, 646,344 pounds of abalone shells, and 204,771 pounds of abalone meats.

BOAT FISHERY.

Fishing grounds.—The fishing grounds most commonly resorted to by the boat fishermen of San Diego are those frequented for gill-net fishing in the bay from Point Loma to some distance southeast of the city and northwardly from Point Loma, both inside and outside the kelp beds; also in False Bay, where nets are used for smelt, herring, and flounders. Gill-net fishing is carried on at all seasons on the grounds stretching for 10 miles northward from Point Loma. During March, April, and May bonito and barracuda are taken by boat fishermen with troll lines and occasionally with gill nets south and west of Point Loma. Traps or pots are set for crayfish or "rock-lobsters" along the main shore inside of the kelp bed, from Point Loma northward. The favorite ground for the collection of large sea clams for bait and food is on the shallow spit called "Zuninga Shoal," extending southwardly for more than a mile from the south side of the channel, opposite Ballast Point, at the entrance of the bay.

Boats.—Many sailboats at San Diego, and particularly those used by the Italians and Portuguese, are the same type as the feluccas sailing from San Francisco. They are tight-bottomed craft, and, as no ice is used on account of its expense at San Diego, the catch of the boat fishermen is often in a bad condition when it reaches port. For this reason the writer has prepared and published plans of a welled boat, in which fish can be kept alive; such a boat might be very advantageously used in the market fishery of San Diego.

Apparatus of capture.—The apparatus of capture used by the boat fishermen consists of gill nets, hand lines, or troll lines, and pots and traps for catching crayfish; the latter are set along the shore with buoys attached to them by lines to mark their positions.

Method of fishing.—The description given of catching bonito, barracuda, and mackerel under the head of vessel fishery will apply to the boat fishery, so far as troll-line fishing is concerned. Two methods are adopted in using gill nets. When nets are set in bays and along the shores they are anchored; but in the open water, 6 or 8 miles outside the kelp fields, they are "set at a drift," the method adopted in the latter case being precisely similar to that used in the so-called "drag net fishery* of New England. The catch around the kelp consists chiefly of bonito, barracuda, rock-cod, and smelt; but in the bays the species principally taken are herring, smelt, and flounders.

The boats as a rule leave San Diego in the early morning, at which time there is generally a land breeze blowing off the coast, that enables them to run to the fishing grounds. In the afternoon a sea breeze usually springs up and with this they return to port with their day's catch, unless the fishermen decide to remain longer on the fishing grounds and return on the second day. Frequently, however, they fail to get the breeze necessary to carry them to the city, and their catch is in a deteriorated condition, and perhaps unfit for food, before they can reach port and dispose of it. Ice is too costly to be used by fishermen, who are therefore often deprived entirely of the results of their labors.

The following tabulated statements show in detail the fisheries of the county in 1888:

Persons employed.

Country.	Nativity.	Nationality.
United States	46	46
Italy	12	12
Portugal	37	37
Sweden	13	12
China	[illegible]	52
Total	159	159

Apparatus and capital.

Designation.	No.	Value.
Vessels* (277.16 tons)	22	$12,2[illegible]
Outfit	......	7,[illegible]
Boats	43	5,910
Gill nets	17	1,125
Drag seines	5	1,000
Hand lines and trawl lines, with 5,400 hooks	......	[illegible]
Crayfish traps	60	90
Shore property	......	1,000
Total	......	32,[illegible]

* Including 13 Chinese junks (141.01 tons), valued at $5,[illegible].

Products and values.

Species.	Fresh.		Salted.		Total.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Fish:						
Barracuda	115,200	[illegible]	213,500	[illegible]	328,700	$17,[illegible]
Bonito	164,[illegible]	4,[illegible]	254,400	10,175.[illegible]	418,[illegible]	15,111.[illegible]
Jewfish	10,000	[illegible]	7,214	[illegible]	17,214	[illegible]
Rockfish	75,000	2,[illegible]	22,[illegible]	[illegible].20	97,[illegible]	3,1[illegible]
Yellow-tail	[illegible]	1,[illegible]	33,[illegible]	1,[illegible]	[illegible]	3,7[illegible]
Miscellaneous species*	15,300	450	....	....	15,300	450.00
Shellfish, crustaceans, etc.:						
Abalone shells	[illegible]	5,750	....	....	[illegible]	5,750.00
Abalone meats	[illegible]	12,000	....	....	[illegible]	12,000.00
Clams	20,000	[illegible]	....	....	20,000	[illegible]
Crayfish	25,400	1,274	....	....	25,400	1,274.00
Total	1,[illegible],400	41,[illegible]	[illegible]	22,[illegible]	2,1[illegible]	[illegible]

* Includes sea bass, smelt, herring, and flounders.

14. FISHERIES OF LOS ANGELES COUNTY.

Geographical characteristics.—Los Angeles County adjoins San Diego County on the northwest, and its coast line has an extent of about 120 miles, the general trend being in a northwesterly direction. Except in the northern section, the shores are generally low with a greater number of small lagoons and sandy stretches of coast than in San Diego County, while bold headlands are less numerous and conspicuous.

The principal indentations are San Pedro and Santa Monica Bays, situated on either side of the broad peninsula upon the extremity of which is located the town of San Pedro. Santa Monica Bay is on the north and San Pedro Bay on the south of the peninsula, and both are open roadsteads, unsheltered from southerly or westerly winds. Wilmington, on San Pedro Bay, 3 miles from San Pedro, on the line of the Southern Pacific Railroad, has the only harbor of any importance on the shores of this county, and this is only a narrow, shallow inlet, somewhat difficult of access to large vessels. The breakwater at San Pedro, which is a railroad terminus, makes a good harbor for fishing boats.

Santa Catalina Island is 18 miles distant from the mainland, and its center bears a little to the west of south from the city of San Pedro. It is about 22 miles long, its length being parallel to the coast, and varies in general width from 3 to 8 miles. The island is mountainous, while the shores are rocky, high, and abrupt. There are no indentations sufficiently large and protected to afford harbor facilities even for fishing boats, except at a point a short distance northwesterly from the center, where the island is very nearly divided, and a harbor is thus formed on each side of the narrow isthmus that connects the two sections. The harbor on the southwestern side is considered the better, it being well sheltered and having a good depth of water. All around the island the water is remarkably clear, so that fish can be seen at a depth of several fathoms.

Fishing centers.—The localities from which fishing is prosecuted are Portuguese Bend, White Point, San Pedro, Wilmington, Santa Monica, and Santa Catalina Island. The latter has no permanent residents except shepherds and a few fishermen.

Portuguese Bend was a shore whaling station of some importance for a number of years, but no whales have been taken there since 1884. It had become an abandoned station as early as 1875, for Jordan records in 1880 that "a whale fishery formerly existed at Portuguese Bend, north of Wilmington; this fishery was abandoned some 5 years ago on account of the difficulty of obtaining water at that place."

The fisheries are largely tributary to the towns of San Pedro and Wilmington, which being situated on a railroad that strikes the coast are the shipping-points for an extensive area in the interior.

Importance of the fisheries.—The seacoast fisheries of this county are, next to those of San Francisco and San Diego, the most important in the State. Compared with 1880, the fishing industry shows a great increase. It is still capable of considerable development, as a result of the increased demand for fish in the growing and already populous regions of the interior reached by the railroad. Much may also be hoped for from the introduction of new and improved methods in handling and shipping fish. Many varieties of excellent food-fish abound. The weather is favorable to fishing a large part of the year, while the fishing grounds are conveniently near the points from which the products must be shipped, the most remote being about Catalina Island, only 18 or 20 miles distant.

Species that are objects of fisheries.—The waters bordering and adjacent to the county of Los Angeles supply a large list of edible fishes, crustaceans, mollusks, etc., among which may be found some of the most desirable species of the Pacific. This will more clearly appear by an examination of the following list and notes, which refer to the more noticeable forms. The first four species mentioned in the list, together with the crayfish or rock-lobster, have the greatest commercial importance at the present time:

Barracuda.
Whitefish (*Caulolatilus princeps*).
Roncador.
Smelt.
Rock bass.
Sea bass.
Jewfish.
Bastard halibut (*Paralichthys californicus*).
Flounders.
Whiting (*Microgadus proximus*).
Sardine.
Yellow-tail.
Mackerel.
Bonito.
Horse mackerel (*Trachurus picturatus*).
Pompano (*S. simillimus*).
Fat-head or redfish (*Trochocopus pulcher*).
Croaker.
Oil shark.
Rockfish (*Sebastichthys*).
Flyingfish (*Exocœtus californicus*).
Perch.
Kingfish (*S. politus*).
Mullet.

Barracuda, bonito, yellow-tail, and several other varieties are taken by trolling in summer, as well as by gill nets, while in winter other species are chiefly sought, among which Jordan mentions *Media-luna*, *Girella nigricans*, rockfish, *Scorpæna guttata*, and *Hypsypops rubicundus*.

Jewfish, though not numerous, attain a large size, ranging from 300 to 400 pounds, while individuals weighing much more are sometimes taken. They are sold fresh, but are also cut into strips, salted, and then dried. The dried product is somewhat tough and of a whitish color, resembling the flesh of the dried cusk (*Brosmius brosme*) as cured in New England.

The mackerel are identical with the bull's-eye or thimble-eye mackerel of the Atlantic. Wilcox states, however, that they are little esteemed even by the coast residents. Alexander says that all the people with whom he had conversed said they had never seen a fat mackerel caught in the Pacific.

Clams and scallops are abundant, but have no market value at present. Campers and ranchmen occasionally visit the beds and obtain supplies for immediate use, but outside of this the consumption is very small. It is reasonable to anticipate marked changes in the demand for these mollusks in the near future.

Several beds of native oysters occur between San Pedro and Wilmington, in San Pedro Bay and other localities, notably at Newport Bay. The oysters attain a fair size for indigenous species, and, according to Wilcox, do not have the strong coppery flavor characteristic of native Pacific oysters in many other places. They are eaten to a limited extent by the old settlers, who are said to have no objection to the peculiar flavor which is almost an insurmountable obstacle to the use of the species by newcomers. A few oysters are utilized, but the demand for them is so small that they are commercially unimportant. In Newport Bay the fishermen occasionally cull the oysters and peddle the selected ones through the country, but this business is of slight importance and scarcely deserves mention. Native oysters are found in Alemidos Bay, but they are too small to be in any demand for food purposes at the present time.

In 1888 one shad weighing 2¼ pounds was taken in San Pedro Bay. This is the only known occurrence of the shad so far south on the Pacific coast.

The oil shark was formerly the object of a considerable fishery, being taken in the lagoons where it went for reproductive purposes. It attains an average length of 4 to 4½ feet and a weight of 40 to 50 pounds, and yields from two-thirds of a gallon to a gallon of oil. The fins of this shark were formerly considered quite a delicacy; they were dried and sold for 12½ cents per pound. This fishery appears to be entirely abandoned as a commercial enterprise, for Wilcox could learn nothing of its prosecution in recent years.

Fishing grounds.—The fishing grounds resorted to by the residents of this county may be classed under three headings: Those about Santa Catalina Island, the "banks" lying between the island and the mainland, and the shore grounds (including clam and oyster beds, etc.) situated along the coast or in the lagoons, bays, etc.

The immediate vicinity of Santa Catalina Island is one of the most important fishing grounds of this county. The bottom is generally rocky and in many places covered with kelp; but the water is very clear, while it is rather shallow about the island. For the most part fishing for bottom species is prosecuted in depths ranging from 10 to 20 feet, where it is practicable to watch every movement of the fish, if the surface of the sea is unruffled by a breeze. The most important species are barracuda, bonito, rockfish, and jewfish. Large schools of herring are frequently seen about this island. Seals and sea lions frequent Santa Catalina Island and the adjacent waters; one may be occasionally shot, but beyond being an annoyance to the fishermen, whose nets they rob, they may very properly be omitted from mention.

The so-called offshore bank lies between Santa Catalina Island and the mainland, being much nearer the latter. Its northern limit is about 6 miles southeast from San Pedro Landing, whence it extends southeasterly, nearly parallel with the coast, a distance of about 20 miles. It is a favorite resort for hand-line fishermen at certain seasons.

San Pedro Bay is much frequented by fishermen using troll lines; gill nets are set in the shallow water along its northeastern shore.

Fishermen.—In 1888 the fisheries of Los Angeles County employed 137 men, of whom all except 3 were foreign-born, though 75 were citizens of the United States. The natives of southern Europe predominate, Portugal, Italy, and Greece being represented, while next in number are the Scandinavians. The American-born fishermen are natives of New England. The Chinese have no foothold, and there is only a single native of the British provinces.

Boats.—The fishing boats are all under 5 tons, and mostly small, undecked craft. The majority are lateen-rigged feluccas or catboats; but there are a few sloops and schooners, with sprit-rigged sails. Some flat-bottomed boats of the sharpie or batean type are used. The sailboats are worth from $75 to $400 each, and the few small rowboats used from $20 to $25 each. The largest sailboats are similar to the feluccas used at San Francisco, and are deemed very seaworthy. A boat is seldom lost here. In 1888 a San Pedro boat was wrecked and her crew of two men drowned, this being the only loss of life there for many years.

Apparatus of capture.—It will be practicable here to refer only to the most important forms of apparatus.

A total of 73 gill nets were used in the fisheries of this county in 1888, and they were employed at all the stations except at Portuguese Bend. A considerable number of species are taken in gill nets, among which the barracuda is one of the most important. The nets are mostly about 40 fathoms long, and range in value from $25 to $30. The barracuda nets are 40 fathoms long and 12 feet deep, made of 9-thread twine, and having a 4-inch mesh. Two or more of these nets are often tied together, end to end, and set in a string.

Nine haul or drag seines, each 600 feet long and valued at $140, were operated from San Pedro and Wilmington.

From all the fishing stations except Portuguese Bend hand lines (including troll lines) and trawls were used to some extent; these have been described elsewhere. There were 41,500 hooks on the trawls, worth, with the lines, etc., $680.

Three bag nets or paranzellas were fished at San Pedro and Wilmington, chiefly in the bay on sandy bottom.

Crayfish pots are used by the fishermen of San Pedro, Wilmington, Portuguese Bend, and White Point. They are operated quite extensively about Santa Catalina Island. They are set along the coast close inshore like lobster pots.

Methods of fishing.—The fishermen start for the fishing grounds on the so-called offshore bank and around Santa Catalina Island, early in the day, timing their departure so that the "land breeze," which usually prevails in the morning, will enable them to reach the desired locality as soon as fishing can be profitably prosecuted. They plan to return about 5 p.m., coming home with the "sea breeze" when practicable.

The fishing crews generally consist of four men on each of the larger boats, particularly those belonging at Wilmington which fish about Santa Catalina Island. These boats do not always return to port the same day they leave home. They also often leave half of their crews at the island to fish in small boats, while the larger craft return to the home ports with their cargoes of fish. The men who stay behind at the island set and haul their gill nets or crayfish pots, or perhaps operate hand lines and trawl lines near the shore. So plentiful are the fish that it often happens that another fare is caught by the time the larger boat returns. Boats that fish upon the bank and those working along the shore near the mainland generally return home every night.

The boats using gill nets may go out late in the day and, having set their gear over night, haul it in the morning and make for harbor, unless they use other gear during the day. All other fishing, however, is usually prosecuted in the early part of the day.

Ice is not used, because it is either not to be had or is scarce and costly.* Boats are frequently becalmed on the fishing grounds or on their return to market, and the entire catch spoils and is thrown away. The loss from this cause is considerable.

Even when the fish are landed in good condition it is seldom that the proper methods for their preservation, packing, and shipment are observed. The round fish are usually left in the boat until the next morning after their arrival, when they are shipped by rail or team in small boxes without ice. The products kept so long in warm weather without refrigeration of any kind must be in a more or less advanced stage of deterioration before they reach the consumer, and at times the railroad authorities have refused to transport fish, knowing they were not in a marketable condition.

In view of these facts it is apparent that welled boats, in which fish can be kept alive, or small steamers that can quickly transport the catch from Santa Catalina, are much needed here, as on other parts of the Pacific coast, to contribute to the full development of the fisheries. By the use of welled boats it will be practicable to remain longer on the distant fishing grounds and, what is of still greater importance, the catch can be landed in the best possible condition, alive. Any surplus could be kept alive in floating live-cars (wherever these can be safely anchored) until demand is made for their shipment.

Prior to adopting this system of bringing in live fish much can be done by giving more attention to the preservation of the catch. If the viscera are removed on the fishing grounds and even a little ice used, the fish being packed in a closely-covered section of the boat, the catch would generally reach port in good condition. Then with a little more ice it could reach a much wider area of distribution than is now possible, while the increase in demand would doubtless more than repay the fishermen for any additional outlay or effort.

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* The price of ice at San Pedro in 1888 was $10 per ton.

It is believed that the fishing interests of this section will be materially advanced when these suggestions are acted upon. The public are not slow to appreciate whatever tends to improve the food supply, and the introduction of advanced ideas in the fresh-fish trade will correspondingly increase the demand for this class of food.

Markets and shipments.—Although Santa Monica, Alemidos Bay, and Newport Landing have local markets and direct trade with the interior, the principal part of the fish taken in this county is first sent to San Pedro and Wilmington, whence the products are shipped to Los Angeles, 25 miles distant, Pasadena, Riverside, Long Beach, and other communities on the line of the railroads. There is also some local demand at San Pedro and Wilmington. Los Angeles, with about 70,000 inhabitants, is the principal market and distributing center for the fishery products of the county. It has five firms engaged in handling fish. About two-thirds of the products landed at San Pedro and Wilmington are shipped by express to Los Angeles, while about one-third is taken in teams from Wilmington, which peddle the fish en route to the same city and dispose of a considerable quantity therein. The fish salted and dried on Santa Catalina Island are cured for the San Francisco market, to which they are sent from San Pedro. The fresh-fish trade, as has been indicated, is comparatively local.

The following tables show in detail the statistics of the fisheries of this county:

Persons employed.

Fishing centers.	Nativity.							Nationality.						
	United States.	British provinces.	Portugal.	Italy.	Sweden.	Greece.	Total.	United States.	British provinces.	Portugal.	Italy.	Sweden.	Greece.	Total.
San Pedro and Wilmington	3	1	22	15	32	6	79	40	.....	10	8	15	6	79
Santa Monica	.....	.....	8	.....	.....	.....	8	5	.....	3	.....	.....	.....	8
Alemidos Bay	.....	.....	8	.....	.....	.....	8	4	.....	4	.....	.....	.....	8
Newport Landing	.....	.....	20	.....	.....	.....	20	10	.....	10	.....	.....	.....	20
Santa Catalina Island	.....	.....	12	.....	.....	.....	12	6	.....	6	.....	.....	.....	12
Portuguese Bend	.....	.....	.....	.....	4	.....	4	4	.....	.....	.....	.....	.....	4
White Point	.....	.....	.....	.....	6	.....	6	6	.....	.....	.....	.....	.....	6
Total	3	1	70	15	42	6	137	75	.....	33	8	15	6	137

Apparatus and capital.

Fishing center.	Boats.		Gill nets.		Bag nets.		Haul seines.		Lines and trawls.		Crayfish pots.		Total capital invested.
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No. of hooks.	Value hooks and lines.	No.	Value.	
San Pedro and Wilmington	36	$7,250	35	$1,000	2	$375	*9	$1,200	....	$610	40	$60	$10,[illegible]
Santa Monica	4	500	7	200	....	....	....	....	....	50	....	....	750
Alamitos Bay	2	600	7	200	....	....	....	....	....	25	....	....	[illegible]
Newport Landing	5	1,500	10	300	....	....	....	....	....	75	....	....	1,875
Santa Catalina Island	12	300	10	300	....	....	....	....	....	120	....	....	720
Portuguese Bend	6	230	....	....	....	....	....	....	....	....	60	75	[illegible]
White Point	4	130	4	100	....	....	....	....	....	50	40	75	[illegible]
Total	69	10,510	†73	2,150	2	375	9	1,200	41,500	[illegible]	140	210	‡15,[illegible]

* Length, 5,400 feet. † Length, 18,200 feet.
‡ In addition to this amount $500 were invested in shore property in this county.

Products and values.

Fishing center.	Fresh fish.		Dried fish.		Crayfish.		Total.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
San Pedro and Wilmington	496,[illegible]	$20,940	....	....	150,400	$3,761	[illegible]	$24,701
Santa Monica	65,000	2,400	....	....	....	....	65,000	2,400
Alamitos Bay	70,050	2,800	....	....	....	....	70,050	2,800
Newport Landing	175,000	7,000	....	....	....	....	175,000	7,000
Santa Catalina Island	....	....	100,000	$5,000	....	....	100,000	5,000
Portuguese Bend	....	....	....	....	(†)	....	....	....
White Point	(‡)	....	....	....	(†)	....	....	....
Total	[illegible]	33,140	100,000	5,000	150,400	3,761	1,[illegible]	41,[illegible]

* Including barracuda, bonito, jewfish, and whitefish, all shipped to San Francisco from San Pedro.
† These are sold at San Pedro and are included in the figures at that place, owing to the difficulty of accurately separating the catch of the fishermen in the different places. The approximate figures for the three localities are: San Pedro and Wilmington, 43,000 pounds; value, $1,070. Portuguese Bend, 53,000 pounds; value, $1,320. White Point, 54,400 pounds; value, $1,371. Total, 150,400 pounds; total value, $3,761.
‡ Included with figures for San Pedro, where the fish are sold.

Fish trade of San Pedro and Wilmington.

Species.	Pounds.	Price per pound.	Value paid by dealers.	Species.	Pounds.	Price per pound.	Value paid by dealers.
		Cents.				Cents.	
Barracuda	[illegible]	3	$[illegible]	Pompano	700	30	$210.00
Bonito	6,250	3	187.50	Rock bass	4,500	5	225.00
Crayfish	150,400	2½	3,761.50	Rockfish	15,130	6	907.80
Croaker	11,250	5	562.50	Sardine	5,140	3	154.20
Flounder	7,175	7	502.25	Sea bass	4,560	5	228.00
Grouper	8,500	5	425.00	Smelt	75,300	5	3,765.00
Halibut	8,360	7	585.20	Whitefish	172,975	4½	7,[illegible]
Jewfish	30,450	3	913.50	Yellow-tail	5,500	4	220.00
Mackerel	7,125	3	213.75				
Perch	8,325	4	333.00	Total	[illegible]	....	26,[illegible]

NOTE.—Shipped to interior by express, [illegible] pounds; by teams, 300,000 pounds; sold locally, [illegible] pounds; total, [illegible] pounds.

15. FISHERIES OF VENTURA COUNTY.

Geographical characteristics, etc.—Ventura County lies between Los Angeles and Santa Barbara Counties, and has a coast line of about 36 miles, with a northwesterly trend. It has no harbors nor any large bays or important indentations. Along the coast is a narrow and more or less sandy plain, which is bordered in the rear by high mountains. The lofty Santa Monica Mountains form the border line between this and Los Angeles County, the ridge running down to the shore and terminating in two rough rocky headlands called Point Duma and Point Conversion. In a similar manner the county is separated on the north from Santa Barbara County by a spur of the Santa Inez Range, which ends at the sea in the bold headland of El Ricon.

According to Jordan, the Ventura River (Santa Clara River on some of the maps), which flows through the county, is the southernmost river in California that is not alkaline at its mouth. Therefore, although brook trout occur "in the headwaters of the Los Angeles and San Luis Rey Rivers, and even in some streams in the San Jacinto Mountains, in San Diego County," the salmon does not enter any river south of this.

Coast towns and fisheries.—Huenema and San Buenaventura are the only coast towns. The fisheries in this county have never been important. In 1880 Jordan records that there was at San Buenaventura "but one professional fisherman, who has in his possession two gill nets and one seine." He learned that there was a small party of Chinamen at Point Magu, 9 miles south of Huenema, who combined the labors of fishing and gardening, while a few Californians and Chinese fished from the wharves at San Buenaventura, and two or three farmers at Laguna Ranch occasionally operated a seine. The county is now without a single professional fisherman, so far as could be learned. A few individuals may occasionally catch a small number of fish for their own use—possibly any surplus may be peddled in the towns or surrounding country; but such operations are carried on in such a desultory and unsystematic way that they do not assume the importance of commercial fishing. Ventura County has in reality no fishery interests; and its short coast line, lack of shelter for boats, and the general character of its shores hold forth little promise for the future.

16. FISHERIES OF SANTA BARBARA COUNTY.

Geographical characteristics.—The coast line of this county, exclusive of the islands, is upwards of 100 miles in length. From Ventura County the coast extends almost due west to Point Conception, thence northwesterly to Point Arguello, where it turns sharply northward, the trend of the shore from this point to its junction with San Luis Obispo County being almost due north. Along the south coast, between the mountains and the sea, there is, over a long section, a belt of rather fertile land, with stretches of smooth, sandy beaches, occasional rocky shores, with few indentations or lagoons. Bordering the shore, about half a mile distant from the land, is a kelp bed with an average width of upwards of 400 fathoms.

Stretching parallel with the coast, at an average distance of about 20 or 25 miles, is a group of rocky islands, some high, rugged, and mountainous, and all irregular in outline. These are the islands of San Miguel, Santa Rosa, Santa Cruz, and Anacapa. Santa Barbara and San Nicholas lie farther out, about 70 miles from the town of Santa Barbara. San Miguel is one of the smallest, being 6½ miles long and 2½ miles in extreme width. Santa Rosa is about 15 miles long by 9 miles wide, and contains about 50,000 acres; it is 27 miles southwesterly from Santa Barbara. Santa Cruz lies to the east of Santa Rosa, and is about 20 miles distant from Santa Barbara. It is 20 miles long and its extreme width is about 5 miles. Off its eastern end is the small island of Anacapa. Between the first four and the mainland is Santa Barbara Channel, an important fishing ground for surface-swimming species. The water is deep, however, and not suited to bottom fishing. These islands bear an important relation to the future development of the fisheries of this region, as will be seen further on.

Santa Barbara is a noted summer watering-place, located on a beautiful, slightly crescent-shaped shore, with a long, sloping sandy beach, and stretches of high hills along its sides. A long pier built on piles is a landing for steamers here; it extends into the bay opposite the town, and affords facilities to the fishing boats that they could not find on the beach, where the water is shallow and the surf breaks with considerable force except in the mildest weather. A wharf was first built in 1868, but the railroad did not enter the town until 1887. The bay is exposed to southerly winds, from the west nearly around to the opposite point, but affords a good shelter when the wind is north of east or west, as is usually the case during a greater part of the year.

Nearly parallel with the beach, and distant from one-third to one-half mile, is a broad belt of giant kelp that floats at the surface, and is so dense that channels have to be cut through it for the steamers. This serves the purpose of a breakwater, when the wind is from southwest to southeast, and makes it possible for the fishing boats to ride safely and with comparative ease at anchor when otherwise they would have to be hauled out on the beach or hoisted to the wharf, at great additional labor to the fishermen.

Fishing centers.—The only town in this county that can at present be considered a fishing center is Santa Barbara. In 1880, when Professor Jordan visited this region, some fishing was prosecuted from Goleta, and one man occasionally fished from the wharf or with a drag seine at Carpenteria, where fishing smacks were also built. For many years crews of Italians and Portuguese located at Goleta Point and near Point Conception to prosecute the whale fishery; but notwithstanding whales are still reported to occur in this region, the fishery was given up some time ago, chiefly because of the low price of oil.* Individuals may occasionally go out for a day's fishing at some other point on the coast, simply for sport or to get supplies for their own tables, but irregular and desultory operations of this kind can not be considered in this connection.

Importance of the fisheries.—Notwithstanding there is no lack of variety or abundance of fish, little attention is given to the fisheries. The business is confined entirely to a small-boat shore fishery, practically controlled by one Italian and one Hungarian, who own nearly all of the boats and fishing gear, and hire other fishermen to go out when the latter are disposed to engage in fishing. As at many other watering-places, the fishermen find it most profitable to serve the pleasure-seekers who frequent this resort, and they engage in fishing only when they can not find other and more lucrative employment. Nevertheless, there has apparently been a moderate increase in the fisheries of the vicinity of Santa Barbara since 1880, though the county as a whole shows a slight decrease. The change is most noticeable in the number of boats employed, there being 24 in 1888 against 5 recorded by Jordan in 1880.

Species, abundance, seasons of occurrence, etc.—The following is a list of the most common and important species that constitute objects of fishery in this county, or which may become commercially important in the near future. Among the latter whales are perhaps the most important.

Sea otter (*Enhydra marina*).
Winter sea lion (*Zalophus californianus*).
Hair seal (*Phoca*).
Whales (chiefly *Rhachianectes glaucus*).
Barracuda, April to November.
Spanish mackerel (*Sarda chilensis*), most of the year.
Mackerel, May to November.
Rockfish (genus *Sebastichthys*), all the year.
Bluefish (*Girella nigricans*), all the year.
Whitefish, all the year.
Halibut (*P. californicus*), all the year.
Smelt, May to November.
Sardine, May to November.
Eel (*Anguilla*), not common.
Yellow-tail, all the year.
Rock bass, May to October.
Kingfish, all the year.
Black perch (family *Embiotocidæ*), all the year.
Red perch, all the year.
Jewfish, all the year.
Pompano, June to September.
Mullet.
Horse mackerel.
Roncador.
Fat-head.
Flying-fish.

Besides the above there are sharks, dogfish, skates, sculpins, and numerous other varieties. Crayfish and abalone may be taken throughout the year. Sea otters occur rather sparsely about the islands, and are hunted there during the fall and most of the winter by native Californians from Santa Barbara, who, during the rest of the year, generally engage in pelagic fur-sealing on vessels sailing from San Francisco. These men return from sea in October and shortly thereafter camp upon the islands, where they also take hair seals for their oil and pelts, and occasionally capture a live seal or sea lion, to sell for exhibition purposes. The sea otter is excessively shy here as elsewhere, but the great value of its pelage is an incentive for the hunter to endure long periods of patient waiting and much exposure.

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* Goleta had been abandoned in 1880, but there was then a whaling company of 20 men at Cojo Viejo, 51 miles west of Santa Barbara; this has also been deserted.

Whales, chiefly the California gray, are reported to be numerous off the coast of this county during the winter, when they frequently come close inshore. In summer they migrate northward. None have been captured, however, in recent years, but quite an important shore whale fishery could be prosecuted, as in former years, if the price of oil should advance sufficiently to make the business remunerative. The profits might now be materially enhanced by the utilization of the carcasses for the manufacture of fertilizer—a product that ought to find a ready sale at good prices.

Barracuda, bonito (commonly known here as "Spanish mackerel" and "skipjacks"), and smelt are the leading varieties of market fish during the summer. Bull's-eye mackerel are moderately abundant and can be taken from May to October.* They are not much esteemed, however.

Albicore, sea bass, yellow-tail, and jewfish are caught in summer.

Crayfish, an important species in this locality, are very numerous, and can be taken at all seasons, though somewhat farther offshore in winter than during the warm season, when they can be taken close inshore.

The abalone is somewhat less abundant on the islands than formerly, but it is still numerous. The unremunerative prices now obtained for the shells deter white men from engaging in the fishery for them. This cause has had more to do with the seeming decline in this fishery than any real scarcity of the species. Only the largest and finest shells are now marketable; tons of slightly inferior quality, that formerly would have brought good prices, are now thrown away. The result is that the abalone fishery has of late come entirely under the control of the Chinese, who, content with small returns, scour the coast in their junks, gleaning whatever of nature's bounty they can secure, for which any market can be found.

The native Californians sometimes eat a few clams, of which there are two or three species; but there is no clam fishery. Oysters and scallops are not taken.

Fishing grounds.—A favorite fishing ground for surface species (barracuda, bonito, etc.), and one of the best on the coast of California, is in the channel between Santa Barbara and the islands (see map, plate 1). The rocky ledges that jut out from the land, intersecting the long stretches of sandy beaches and shallow inshore bottoms, are considered excellent fishing grounds. Along the shore, between Los Pueblos and Carpenteria, is said to be one of the best localities for hook-and-line fishing on the coast of this county. There are excellent grounds for gill-net and line fishing about the islands of Santa Rosa and Santa Cruz.

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*Alexander says the bull's-eye does not occur anywhere along this coast in abundance to be compared with the common mackerel in the Atlantic.

Fishermen.—There are only 15 persons in this county, including the seal and sea-otter hunters, who may properly be called fishermen. Of these 8 are natives of foreign countries (including 1 Chinaman) and 7 are native Californians.

Boats.—The little fleet of fishing boats sailing from Santa Barbara are all less than 5 tons burden. They are mostly sailboats, as follows: 1 sloop, worth $600; 8 lateen-rigged feluccas, averaging about $112 each; and 3 sprit-rigged boats with an average value of $100. Besides these there are 7 small rowboats with a total value of $75.

Apparatus of capture.—Gill nets are employed chiefly in winter time, when the fish have moved off into comparatively deep water. They are set at the islands and along the shores of the mainland. The nets are commonly about 40 fathoms long, 15 feet deep, and have a mesh varying from less than 2 inches to 3 inches. Thirty-five nets are used, of which 10 are classed as bass nets, 11 as smelt nets, and 14, with a mesh of 3 inches, have no special classification.

Fourteen trammel nets are used. They are preferred for some kinds of fishing, because fish of varying sizes can be taken in them.

Three small shore sweep seines, with an average value of $100, are used at Santa Barbara. These average 50 fathoms in length, 2 fathoms in depth, and have a ½-inch mesh. They are operated in the shallow water along the beaches.

Trawl lines are used for rockfish about Richardson's Rock, on the ground west of San Miguel Island, and also south of Anacapa Island. (See map, plate I.)

Troll lines similar to those already described (page 30) are used to capture barracuda, bonito, mackerel, etc., in Santa Barbara Channel.

In winter a hook-and-line rig is often operated from the wharf at Santa Barbara, and sometimes this gear is used in the kelp beds.

In summer, when the crayfish are abundant near the shore, a hoop net or bag net (locally called a "crayfish trap") is used. But in winter, when the "rock-lobster" is farther offshore in deep water, the regular crayfish pot, made of laths, is preferred. The "trap" is essentially the same form of apparatus as the "hoop net" formerly used in the New England lobster fisheries. It consists of a net bag hung to an iron hoop, so that it will have a depth in the center of about 3 feet, which is equal to the diameter of the hoop. Crossing this hoop at right angles, and arching above it with a moderate curve, are two wooden hoops seized together where they intersect, and having their ends securely fastened to the iron. Attached to the wooden hoop at the point of intersection is a string for fastening the bait, and sometimes this is provided with a hook. A triangular bridle of line is attached to the iron hoop and the buoy line is bent to the bridle where the several parts unite. This bridle is so arranged that when the fisherman pulls upon the buoy line the trap is lifted so that the iron hoop hangs horizontally and can be pulled up in this way without danger of spilling the contents of the bag.[*]

Methods of fishing.—The methods of fishing, so far as they apply to the use of gill nets, drag seines, troll lines, and trawl lines, are essentially the same as in other localities. It need only be said that in all hook-and-line fishing crayfish are the most tempting bait. Brief allusion may, however, be made to the method of fishing with the hoop "traps" for crayfish. These are set in shallow water inside the kelp beds that fringe the coast. Almost anything in the shape of fish answers for bait, but bonito is believed to be most attractive to the rock-lobster. The location of each trap is marked by a small buoy attached to the top end of the buoy line, which bobs up and down on the waves at the surface. When set, the net lies loose and flat on the bottom, with the iron hoop resting upon its edge, while the bait hangs over the center. There is nothing to prevent the crayfish from escaping after they have eaten the bait, though it is natural for them to lie upon the net beneath the lure until they have consumed it. For this reason the fishermen carefully watch their nets, rowing along from buoy to buoy, peering down over the boat's side into the water to see if any crayfish are in the traps. If one is seen on the net it is quickly pulled up and, being prevented from escaping by the depth of the bag, is taken into the boat and the trap is reset, new bait being put on if necessary.

Sea otters, seals, and sea lions are killed by shooting them; the use of firearms about the islands has a tendency to increase the remarkable natural shyness of the sea otter and to render its capture more difficult.

Preparation of products, markets, and shipments.—The fish are mostly sold fresh; a few are dried in the fall and early winter and shipped to San Francisco. The abalone meats are dried, and the shells prepared in the ordinary way. These are taken by Chinese in junks from San Diego or San Francisco; but, as the shells are obtained in this county and shipped from Santa Barbara, the products have been included here, and are additional to what has been credited to the junks.

Seal oil is tried out by the fishermen; it is worth only $10 a barrel.

Most of the fish are consumed locally. The majority of those not taken by the local trade are sent to San Francisco in a fresh condition. A large percentage of the crayfish go to this market; but the demand for crayfish appears to have greatly decreased since 1880, when, according to Jordan, Santa Barbara supplied nearly all the demand for this crustacean at San Francisco, and the catch was about ten times as much as now, or a total of 90 tons per annum.

The want of a convenient market is severely felt by the fishermen. It is thought that a good demand could be created along the line of the railroad connecting Santa Barbara and Los Angeles if effort were made to properly dress and preserve the fish before shipment. A trade in salt or dried fish could, no doubt, also be inaugurated.

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[*] The same result was obtained with the New England lobster net by using a single line bent to the wooden hoops where they cross each other. This is a simpler and cheaper method.

The following tabulated statements show in detail the statistics of the fisheries and fish trade of Santa Barbara County for 1888:

Persons employed.

Country.	Nativity.	Nationality.
United States	7	7
Austria	4	4
Italy	3	3
China	1	1
Total	15	15

Apparatus and capital.

Designation.	Number.	Value.
Boats	24	$2,375
Gill nets	*21	730
Trammel nets	14	580
Haul seines	3	300
Trawl lines	†22	77
Crayfish pots	60	120
Shore property		300
Total		4,482

*3,800 feet in length. †These were provided with 3,300 hooks.

Products and values.

Species.	Quantity.	Value.
Fresh:		
Barracuda ... pounds	16,000	$800.00
Bonito ... do	25,000	1,250.00
Sea bass ... do	20,000	1,000.00
Rockfish ... do	18,000	900.00
Smelt ... do	7,000	350.00
Mackerel ... do	2,000	100.00
Other fish ... do	2,320	116.00
Crayfish ... do	18,200	900.00
Abalone meats ... do	36,050	2,042.75
Abalone shells ... do	19,775	247.18
Dry fish ... do	6,325	316.25
Total	170,670	8,022.18
Hair-seal skins ... number	650	650.00
Sea-otter skins ... do	25	2,500.00
Live seals ... do	10	400.00
Seal oil ... barrels	11	110.00
Total		3,660.00
Grand total		11,748.18

Monthly shipments from Santa Barbara County to San Francisco by the Pacific Coast Steamship Company, in 1888.

Month.	Dry fish.	Fresh fish.	Abalone meat.	Abalone shells.	Live seals.	Seal skins.	Seal oil.	Cray-fish.*
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*No.*	*No.*	*Bbls.*	*Lbs.*
February		280		1,010	8			
March				3,180				
April					4			
June		1,600			4	246		
July		200				354	9	
August			15,730					
September			15,440	13,525				
October	2,625							
December	3,700		2,880	2,060		50	2	
Total	6,325	2,080	34,050	19,775	16	650	11	12,000

* Dates of shipments of crayfish not given.

17. FISHERIES OF SAN LUIS OBISPO COUNTY.

Geographical features.—The coast line of San Luis Obispo County has a general direction about NNW. and SSE. and is 80 miles long in a straight line. It is, however, irregular in contour and would measure considerably more by following the curve of the bays of San Luis Obispo, Esteros, and San Simeon, which indent the shore. There is no harbor, and the nearest approach to one is the "one-sided" shelter at Port Harford, on the north side of San Luis Obispo Bay, where there is a long pier at which the coast steamers touch to connect with the railroad. A breakwater is being built at Point San Luis, as a protection to Port Harford, and it is expected this will extend seaward a mile or more in a southeasterly direction. Port Harford is the only railroad terminus on the coast of this county; it is about 198 miles (by sea) from San Francisco, and is the port of San Luis Obispo, a thriving town of about 4,500 inhabitants, 10 miles inland. Being the principal point from which fish can be conveniently shipped to the interior, or to San Francisco, it is the center of the limited food-fish fishery, and there is no other fishing station in the county except at San Simeon Bay, 38 miles northwest of Port Harford, where whaling is prosecuted and where one man catches a few smelts and rockfish that are sent to San Francisco by steamer.* The coast is high and broken in sections, but there are long stretches of sandy beaches, with shallow spits or reefs extending into the sea, which uncover at low tide and upon which native clams occur in abundance.

Importance of the fisheries.—The fisheries of this county are not important at the present time. It is reported, however, that fish occur in great variety, and even more abundantly than farther south. There is apparently no lack of supply, and for this reason the fishing interest is capable of material advancement and may reasonably be expected to keep pace with the increase of population; while still greater improvement may be anticipated if desirable changes in methods are adopted, which will tend to a wider distribution of products.

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* The fisherman at San Simeon Bay is one of the whaling crew at that station, and fishes for food species when not engaged in whaling.

Compared with the figures obtained in 1880, there has been a very gratifying increase in the product and value of the food-fish fishery. In 1880 the yield of food-fish obtained in this county, exclusive of shellfish and crustaceans, amounted to 84,000 pounds, with a value of $2,520. In 1888 the product was 129,627 pounds of fresh fish and 10,000 pounds of salt fish, with an aggregate value of $4,482.81. There has been, however, a material decrease in the whale fishery, which will be more fully discussed in a succeeding paragraph.

Species, seasons of occurrence, etc.—The species here do not vary materially from those given under the head of Santa Barbara County, and there is practically no difference in those most important for food purposes. In the following notes special mention is omitted of species of secondary importance.

Mackerel were not known to enter San Luis Obispo Bay till 1887, during which and the following year the species was very abundant in August, September, and October, at times appearing in large schools. In 1888 the first fish were taken on August 10 and the species remained well into November. They averaged nearly 3 pounds in weight.

Barracuda are chiefly taken in July, August, and September, but are also caught between February and December. They average 6½ pounds, some reaching 12 pounds. Small fish occur throughout the winter.

The sea bass is one of the most important species of the county, as it is of the entire State. During August and September, 1888, they were very abundant, and they were also taken, in smaller numbers, in October and November. They weigh from 3 to 75 pounds, averaging about 20 or 25 pounds. They arrive in schools containing fish of uniform size and resort chiefly to the kelp beds along the shore.

Bonito and horse mackerel occur at the same season and under about the same conditions as the barracuda. Rockfish of numerous varieties are taken in greater numbers than any other species, and constitute about one-third of the entire catch. Bastard halibut (*P. californicus*), of from 10 to 60 pounds, are taken near the wharf at Port Harford, but are not abundant. Smelts reach this part of the coast in March and become abundant during summer and fall; a few remain all the year. Sardines and herring arrive after the main body of smelts, and both are taken with set and drift gill nets. Pompano, kingfish, perch, bluefish, and other varieties are caught in small quantities. Shad have not been seen in this county so far as could be learned.

Whales appear chiefly in fall and winter, as on other parts of the coast south of San Francisco. Four species, the humpback, California gray, finback, and sulphur-bottom, are said to occur, but only gray whales were taken in 1888. These are about 35 to 40 feet in length, and yield about 25 or 30 barrels of oil.

Clams are plentiful on the shallows bordering the beaches, but they are not taken in large numbers. Abalone shells occur on the rocky shores, but are not numerous; only a few are incidentally taken.

Fishermen and shoresmen, lay, etc.—There was a total of 25 fishermen in this county in 1888, representing many nationalities. One native of New England, who had been trained in the arts of a fisherman on the coast of Maine, has established his home on a small rocky islet (near Port Harford) that rises 50 or 60 feet above the sea, its naked wind-swept sides and crest barren of vegetation. Besides Americans, there are natives of five European nations. Portugal and Norway are most numerously represented. Russia comes next with two men, while there is a single fisherman each from Great Britain and Denmark. In addition, there are two American-born shoresmen who find occupation in marketing or shipping the products.

There is practically no lay in the food-fish fishery, since the fishermen own their boats and equipment, and all that is received for fish, etc., belongs to them. The lay of the whalemen at San Simeon Bay, according to Alexander, is as follows: The harpooner receives one-sixteenth of the proceeds and each member of the crew gets one-fiftieth. Only two of the men remain at the station during summer to look after the boats, gear, etc., for which some allowance is probably made.

Boats.—There is nothing very distinctive about the boats used in this county; 19 are employed; 2 are small sloops, each less than 5 tons; 8 are cat-rigged, and 9 are whaleboats of the ordinary type employed in shore whaling; 3 of the latter are fitted with a pivot gun at the bow in addition to the ordinary equipment of a whaleboat. Each boat is valued at $200, including oars, besides which she has the following equipment: Harpoon gun (swivel, English make), worth $120 (cost $200 new); bomb gun (American make), value $50; bombs, $25; whale line, $125; sundries (including hand lances, harpoons, etc.), $80.

Fishing grounds, apparatus, methods, etc.—Mackerel are caught chiefly near the shore, for a mile or two on either side of Point San Luis, and around the whistling buoy, about a mile southeast from the point, in from 13 to 17 fathoms of water. The New Englanders have introduced the method of jigging mackerel, and it has proved successful; most of the mackerel taken are caught this way. The jigs are similar in form and construction to those used in catching the common mackerel (*S. scombrus*) in the Atlantic, but are much larger.

The principal trawling grounds for rockfish are in San Luis Obispo Bay, in 6 to 12 fathoms, from ½ to 2 miles or more from shore, and along the coast north of Point San Luis, in 11 to 18 fathoms, on a variable bottom consisting chiefly of gravel, broken shells, and spots of barnacles. Rockfish are also caught to a less extent with hand lines on these grounds. The favorite fishing grounds for bass is on the east side of San Luis Obispo Bay, in from 2½ to 5 fathoms, where gill nets are set in and near the kelp beds frequented by this genus. Bass are also taken in drift nets farther out, as are bonito, mackerel, and horse mackerel. The two latter species, as well as the barracuda and some others, are caught by trolling with hook and line, but apparently to a less extent than by nets. Bastard halibut are caught in limited numbers close inshore between Point San Luis and Port Harford wharf.

San Luis Obispo Creek empties into the bay of the same name east of Port Harford. The stream is shallow and unimportant, but a few herring are taken in it with gill nets, and occasionally a salmon is caught; but the capture of salmon is comparatively so rare and so entirely an incident of the fisheries that no reliable statistics could be obtained.

The principal clam grounds are on the beach, nearly 10 miles long, on the east side of San Luis Obispo Bay, at and near Pismo Landing, a long pier 7 miles east of Port Harford. On Esteros Bay, about 15 miles (by sea) northwest of Port Harford, is another excellent clam ground, but no clams are dug there except by ranchers living in that locality, who supply their own tables. A fresh-water stream empties into the bay at this point, and the locality has been spoken of as a good site for the cultivation of oysters. In addition to the clams dug on these beaches by the ranchmen, two men make a business of digging and peddling their products through the interior, selling at $1.50 to $2 per 100 clams.

The shore whale fishery.—San Simeon Bay and vicinity and about "Whalers' Point," near Port Harford, have been considered the best grounds in this county for whaling. Whales are said to be scarcer than formerly along this section of the coast. It is believed by some of the old fishermen that this scarcity is to some extent due to the presence of steamers on the coast.

From 1869 to 1887 a shore whaling station was maintained at Whalers' Point, where, it is said, as many as 30 or 40 whales were taken in the most prosperous seasons. But in 1887, the last year of the fishery at this place, only 5 whales were captured. The scarcity of whales, together with the low price of oil, contributed to the abandonment of the station. The whaling company here consisted of 20 men, who operated 3 boats manned by 6 men each. In 1880 there were 21 men.

A whaling station was established at San Simeon Bay in 1865 by a man who had formerly engaged in this fishery at Monterey, San Diego, and Portuguese Bend. The business has been continued, with, perhaps, temporary intermissions, until the present time. Between 20 and 30 whales have often been taken in a season, and an average of 17 for the first 16 years. This station, as well as the other shore whaling stations along the coast, was reported as closed during the early part of 1888, but was reopened in the fall, and up to March 9, 1889 (at which time the fishery was suspended), 14 whales had been taken, which yielded 440 barrels of oil, valued at $5,720.*

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* In the tabulated statement the amount and value of oil obtained in the calendar year ending December 31, 1888, is given. The products and values for the season are more correctly represented by the figures stated above. The whales captured prior to December 31, 1888, were comparatively small, seven of them yielding only 180 barrels of oil, while the same number of "fish" taken between January 1 and March 9, 1889, produced 260 barrels of oil.

There are 9 whaleboats, of which a certain number are kept ready and fully equipped for immediate use, the others being held in reserve to supply the place of a "stove boat," to assist in towing dead whales to shore, or to render any other necessary service.

The season is from November to the middle of March, after which date the whales have generally left the coast on their annual migration north.* The species taken here is usually the gray whale; the humpback or "summer whale" is rarely captured, and the same may be said of the right whale. The best success is usually met with in the early part of the season, when the whales are going south, for in the late winter and spring, when returning, they keep farther off shore, and the prevailing northerly winds and rough sea often prevent their successful pursuit. Besides, as they are then in poor condition, there is not the same inducement to hunt them.

Organization of whaling camp, methods, etc.—Captain Scammon writes as follows:

> The organization of each party is nearly on the same plan as that of the whale ship's officers and crew, all being paid a certain share, or lay, which corresponds to the position or individual services rendered by each member. A "whaling company," as it is termed, consists of one captain, one mate, a cooper, two boat-steerers, and eleven men; from these, two whaleboats are provided with crews of six men each, leaving four men on shore to take their turn at the lookout station to watch for whales and to tend to boiling out the blubber when a whale is caught. The stock of the company consists of boats, whaling implements, and whaling gear, which is divided into sixteen equal shares, and the "lay" of each member is the same. The captain and mate, however, are paid a bonus of $200 or $300 for the term of the engagement, which is 1 year, and they are also exempt from all expenses of the company.
>
> The cruising limits of the local whalers extend from near the shore line to 10 miles at sea. At dawn of day the boats may be seen careening under a press of sail, or propelled over the undulating ground swell by the long, measured strokes of oars, until they reach the usual whaling ground, where the day is passed plying to and fro, unless the objects of pursuit are met with. * * * Generally whales are first seen from the boat, but occasionally they are discovered by the man on watch at the station, who signals to the boats by means of a flag elevated upon a pole with which he runs toward the quarter where the whales are seen; or a series of signals is made from a tall flagstaff.
>
> The cetaceous animals frequenting the coast, having been so long and constantly pursued, are exceedingly shy and difficult to approach, and were it not for the utility of Greener's gun the coast fishery would be abandoned, it being now next to impossible to strike with the "hand harpoon." At the present time (1874) if the whale can be approached within 30 yards it is considered to be within reach of the gun harpoon. When the gunner fires, if he hits the game, the next effort is to haul up near to shoot a bomb lance into a vital part, which, if it explodes, completes the capture; but if the first bomb fails, the second or third one does the fatal work. The prize is then towed to the station, and, if it be night, it is secured to one of the buoys placed

---

*Alexander states that "December, January, and February are the months in which whales frequent this locality; sometimes, however, a few are seen as late as the middle of March. These months are called the "down-run" season; the "up-run" is of short duration, which, as a rule, lasts from 4 to 6 weeks. Whales when migrating north are poor, but on their return south are invariably fat and contain about 50 per cent. more oil than when on their northern passage."

> for the purpose, a little way from the surf, where it remains until daylight or until such time as it is wanted to be stripped of its blubber. The whales generally taken by the shore parties are humpbacks and California grays; but occasionally a right whale, a finback, or a sulphur-bottom is captured. (Marine Mammalia, pp. 247-250.)

The difficulty of killing the finback, and the fact that it has only a thin coating of blubber and yields but a small amount of oil, deter the whalemen from attempting its capture, though it is reported to be abundant. The sulphur-bottom is also said to be fairly numerous in recent years, but it is the most dangerous to attack and the hardest to kill. The whalemen do not like to fasten to whales of this species, and their capture is attempted only when they can be approached near enough to shoot bomb lances into them.

Usually the whales are stranded upon the beach, where they are held in the edge of the surf, while the process of flensing or "cutting-in" (stripping off the blubber) is performed. The blubber is taken off in large oblong flitches or square pieces, one or more men standing upon a whale and cutting vigorously with sharp spades. When one side is stripped, the animal is rolled over by tackles. (See plate III.)

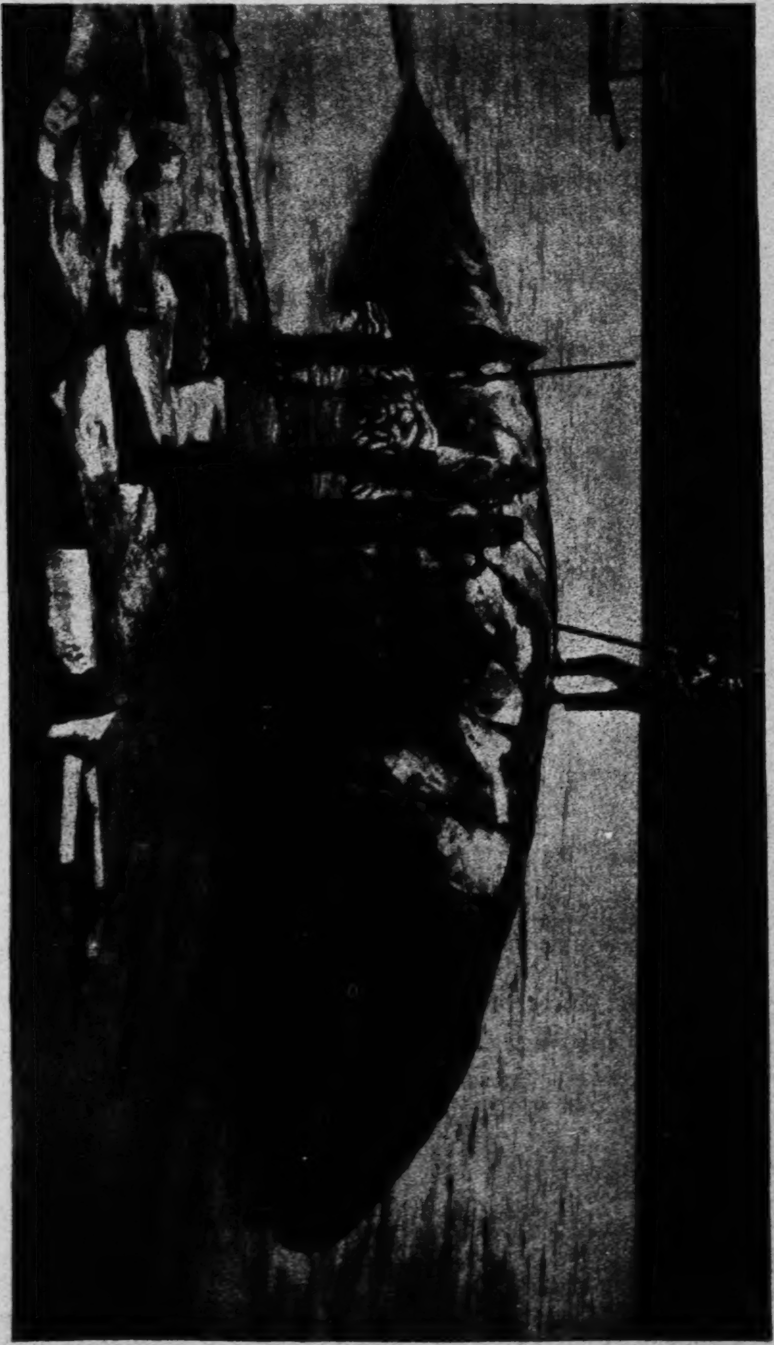
Captain Scammon thus graphically describes the scene at one of these shore whaling stations during the period when a whale is being "cut-in" and the process of "trying-out" is in full blast:

> Near by are the try-works, sending forth volumes of thick black smoke from scrap fire under the steaming caldrons of boiling oil. A little to one side is the primitive storehouse, covered with cypress boughs. Boats are hanging from the davits, some resting on the quay, while others, fully equipped, swing at their moorings in the bay. Seaward, on the crest of a cone-shaped hill, stands the signal pole of the lookout station. Add to this the cutting at the shapeless and half putrid mass of a mutilated whale, together with the men shoving and heaving on the capstans, the screaming of gulls and other sea fowl, mingled with the noise of the surf about the shores, and we have a picture of the general life at a California coast whaling station. (Marine Mammalia.)

Preparation of products, markets, etc.—The greater part of the food-fish products of this county is marketed fresh, but a portion is salted; the quantity so prepared in 1888 was 10,000 pounds. Among the cured fish may be included mackerel, some of which are salted and dried as cod are. The fact that the Pacific mackerel are not fat or oily, as is usually the case with the common species, except in spring, renders it possible to cure them in this way. Other products, such as abalone shells, clams, etc., are prepared or marketed in the ordinary way.

The markets are San Francisco and the interior towns, notably San Luis Obispo. All the products of the whale fishery and the limited abalone fishery go to San Francisco, where also were sent 69,427 pounds of fresh food-fish, and 10,000 pounds of clams; 60,000 pounds of fresh fish, and 10,000 pounds of cured products were sold by peddlers, or shipped to the interior towns by rail. The salt fish are generally sold by peddlers to ranchmen in the vicinity of fishing stations.

The demand for fresh fish at San Luis Obispo and the other towns



CUTTING IN A WHALE. SAN SIMEON BAY.

on the line of the railroad terminating at Port Harford is frequently in excess of the supply obtained by the few coast fishermen. But during the season when migratory species appear there is generally a surplus, which is shipped by steamer to San Francisco.

The following tables show in detail the principal phases of the fisheries and fish trade of San Luis Obispo County in 1888:

Persons employed.

Country.	Nativity.	Nationality.
United States	*6	*12
Portugal	12	8
Norway	5	3
Great Britain	1	1
Denmark	1	1
Russia	2	2
Total	27	27

* Including two shoremen.

Apparatus and capital.

Designation.	No.	Value.
Boats	10	$2,500
Gill nets	40	2,000
Lines	......	125
Whaling outfit	......	800
Shore property	......	200
Total	......	5,625

*Products and values.**

Products.	Sold fresh.		Salted.	
	Pounds.	Value.	Pounds.	Value.
Rockfish	51,654	$1,550	......	......
Sea bass	37,763	1,133	2,500	$150
Barracuda	18,010	540	1,000	60
Mackerel	10,400	312	2,000	120
Bonito	......	......	3,000	180
Halibut (bastard)	2,000	60	......	......
Smelt	1,600	48	......	......
Horse mackerel	......	......	1,500	90
Other fish	†8,000	240	......	......
Abalone shells	1,240	30	......	......
Clams	10,000	900	......	......
Total	140,667	4,813	10,000	600

* The manufactured products consisted of 180 barrels of oil, valued at $2,340.

† Including herring, "sea trout," kingfish, and perch.

Shipments from Port Harford, California, during 1888.

Species.	By railroad and peddlers.		By steamer to San Francisco.
	Fresh.	Cured.	Fresh.
	Pounds.	*Pounds.*	*Pounds.*
Rockfish	45,000	....	6,654
Sea bass	3,000	2,500	24,763
Barracuda	1,000	1,000	17,010
Mackerel	2,000	2,000	8,400
Bonito	....	3,000	....
Halibut	....	....	2,000
Smelt	....	....	1,000
Horse mackerel	....	1,500	....
Abalone shells	....	....	1,240
Clams	....	....	10,000
Other fish	*2,000	....	....
Values	$1,800	$600	$2,065

* Including herring, "sea-trout," kingfish, and perch.

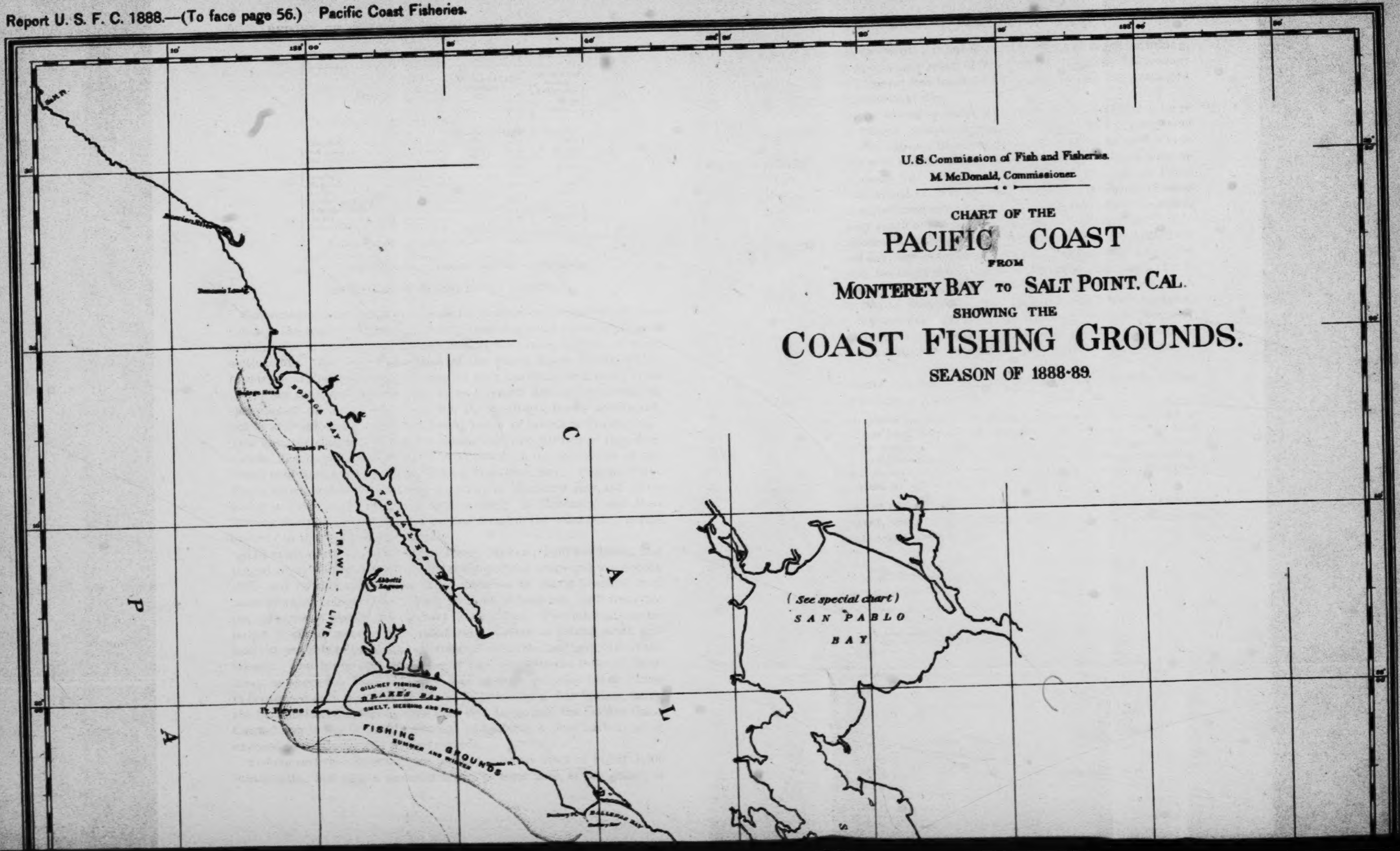
18. FISHERIES OF MONTEREY COUNTY.

Geographical characteristics.—From its junction with San Luis Obispo County, the coast of Monterey County stretches away to the northwest to Point Sur in an almost unbroken line, without bays, harbors, or coast settlements. The high mountains of the Santa Lucia Range, which terminate at Point Carmel, run parallel with the shore, and being close to the sea they shut off the interior and render fishing impossible on this part of the coast. At Point Sur the shore line bends northward, but is still unbroken, to Point Lobos, north of which is Carmel Bay. This bay, the shores of which are subdivided into Stillwater Bay, Pescadero Beach, and Chinese Cove, is situated on the south side of the broad peninsula that separates it from Monterey Bay. Beyond Point Pinos, which marks the southern boundary of Monterey Bay, the shore makes a bold curve, sweeping southeasterly to Monterey and then turning sharply northward, the general trend of the coast being northeasterly to the limits of the county.

The coast north of Point Lobos is very broken; bold headlands and jagged rocky shores, bristling with sharp-pointed crags and wave-worn cliffs and bowlders, alternate with stretches of sandy beaches, from some of which comparatively level sections of land run back from the sea. In many places the scenery is very fine. The indentations referred to afford more or less satisfactory shelter to fishing craft, and make it possible to prosecute the fisheries from the northern end of the county. The lower end of Monterey Bay, opposite the town of Monterey, is sheltered from southerly and westerly gales by Point Pinos. It is exposed only to northerly winds, is generally a fair harbor, being the best-sheltered anchorage between San Diego and the Golden Gate. Carmel Bay is less favorably situated and affords a poor harbor, being exposed to southerly and westerly winds.

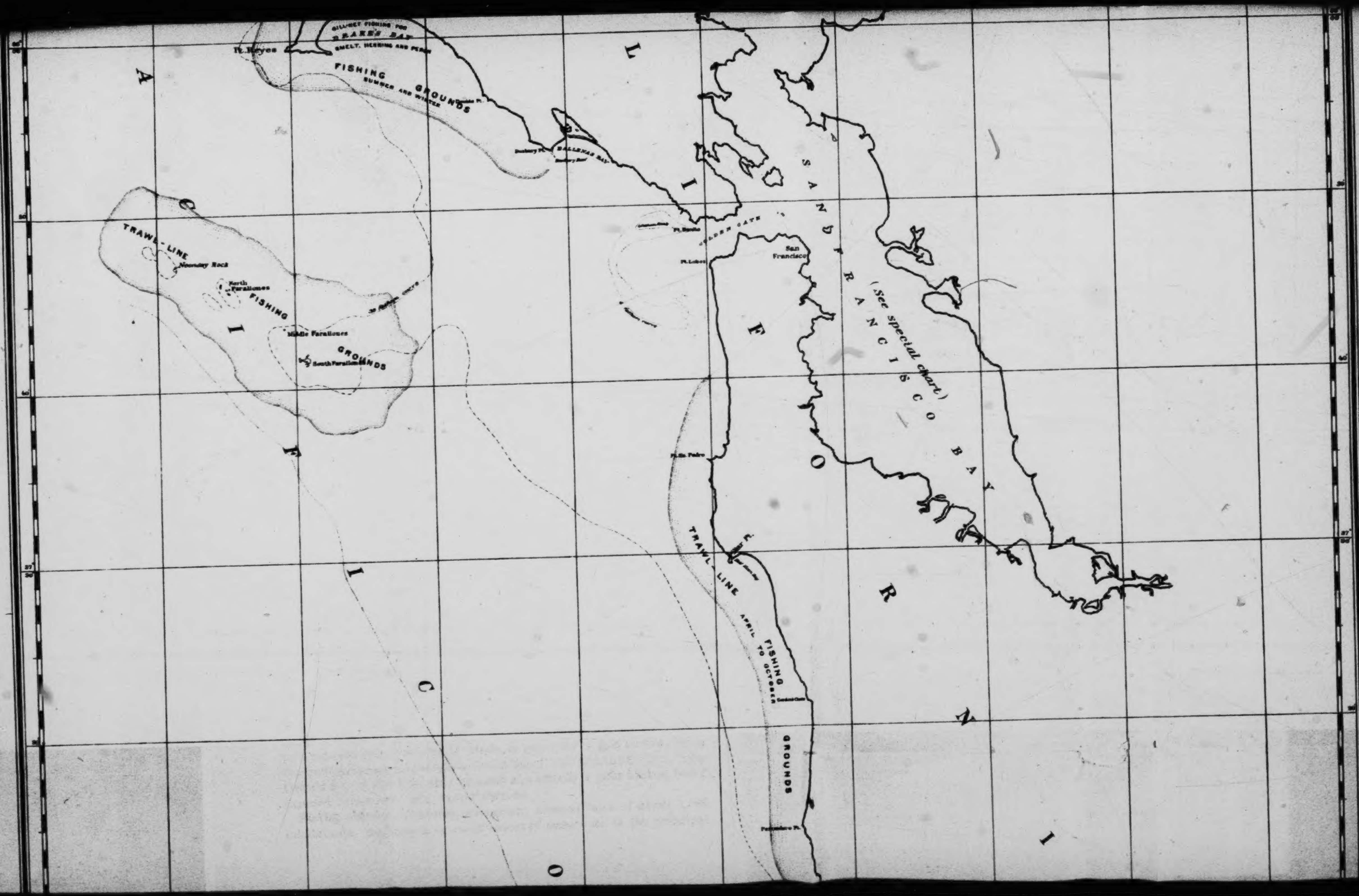
Fishing centers.—Monterey, an ancient mission town of about 1,500 inhabitants, and now a seacoast resort of some note, is the principal

PLATE IV.

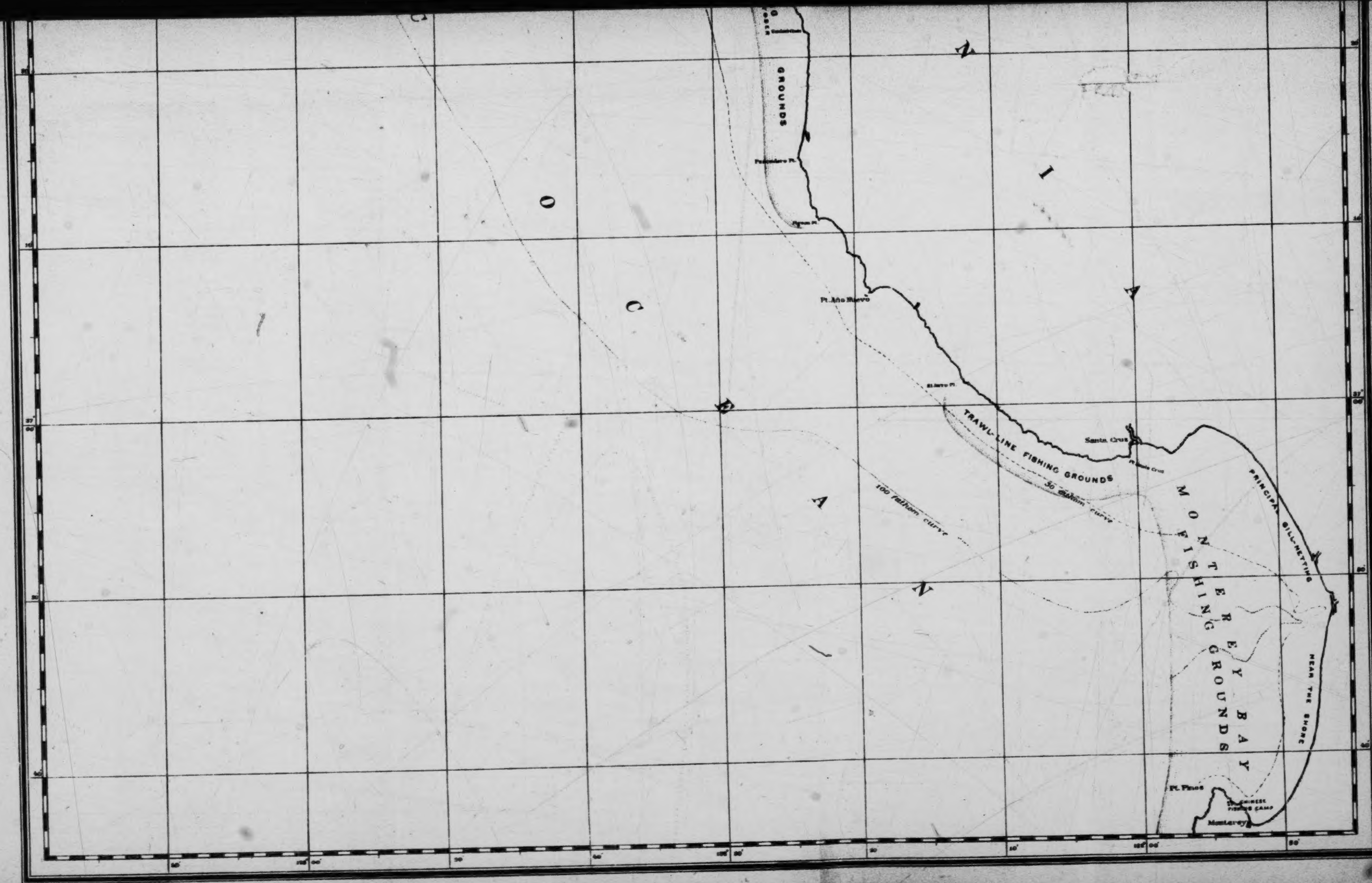

Salt Pt.
Russian River
Duncan's Landing
Bodega Head
BODEGA BAY
Tomales Pt.
TOMALES BAY
Abbott's Lagoon
TRAWL LINE
GILL-NET FISHING FOR
DRAKE'S BAY
SMELT, HERRING AND PERCH
Pt. Reyes
FISHING GROUNDS
SUMMER AND WINTER
Duxbury Pt.
Duxbury Reef
BOLINAS BAY
P
A
C
A
L
S
(See special chart)
SAN PABLO
BAY
10'
123° 00'
50'
40'
122° 30'
20'
10'
122° 00'
50'

U. S. Commission of Fish and Fisheries.
M. McDonald, Commissioner.

CHART OF THE
PACIFIC COAST
FROM
MONTEREY BAY TO SALT POINT, CAL.
SHOWING THE
COAST FISHING GROUNDS.
SEASON OF 1888-89.



Pt. Reyes
GILL-NET FISHING FOR
DRAKE'S BAY
SMELT, HERRING AND PERCH
FISHING GROUNDS
SUMMER AND WINTER
Duxbury Pt.
BOLLENAS BAY
Duxbury Reef
TRAWL-LINE
Noonday Rock
North Farallones
FISHING
Middle Farallones
GROUNDS
South Farallones
Pt. Bonita
GOLDEN GATE
Pt. Lobos
San Francisco
SAN FRANCISCO BAY
(See special chart)
Pt. San Pedro
TRAWL-LINE
APRIL TO OCTOBER
FISHING
GROUNDS
Pescadero Pt.
A C I F I C O
L I F O R N I


GROUNDS
Pescadero Pt.
Pigeon Pt.
Pt. Año Nuevo
TRAWL-LINE FISHING GROUNDS
30 fathom curve
100 fathom curve
Santa Cruz
Pt. Santa Cruz
MONTEREY BAY
FISHING GROUNDS
PRINCIPAL GILL-NETTING NEAR THE SHORE
Pt. Pinos
CHINESE FISHING CAMP
Monterey
O C E A N
N I A
37° 00'
123° 00'
122° 00'
Forbes

fishing center of the county; it has many natural advantages for fishing, and is, besides, within easy reach of San Francisco by rail; the journey can be made in 7 hours; fish landed here in the evening are marketed at San Francisco the next day.

At Point Alones, about 1½ miles northwest of Monterey, is a large Chinese fishing village, composed of rude shanties; this "camp" was started in 1863, and appears to be one of the most thriving settlements of its kind on the west coast. At Pescadero, on Carmel Bay, is another Chinese fishing camp, but second in importance to the one at Point Alones; this was settled in 1868 and has a resident population of some 30 fishermen; it is picturesquely situated on a road that skirts the shore, and is within easy reach of the fishing grounds in Carmel Bay.

Species, abundance, migrations, etc.—Monterey Bay is celebrated for its abundance of fish, and is especially noted for apparently being the limit of migration for many species that occur north and south of this point. Of the many species of fish found in abundance farther south (especially the bonito, barracuda, mackerel, sea bass, horse mackerel, and pompano), few are ever seen in great numbers north of Monterey Bay. It is said that many northern species, among which the salmon is included, are generally rare south of this point, and are sometimes not to be found.

In 1889 mackerel and barracuda were quite plentiful as late as December 7. According to Alexander:

> The first-named species has never before been known to remain on the coast so late in the season; the 1st of September is, as a rule, about the time it leaves; after that date it is seldom caught. The Pacific mackerel, like the Atlantic species, are very erratic, and very little is known as to their migratory habits. Fishermen approximately foretell the arrival of other fish, but the movements of the mackerel are acknowledged to be too ambiguous for their comprehension.

The following list includes the principal species of fish in this county; there are, however, many other varieties that are caught occasionally, also squid, crustaceans, shellfish, etc.:

Name of species.	When found.
Rockfish; rock-cod (*Sebastichthys*)	All the year.
Flounders	Do.
Perch (*Ditrema* and *Holconotus*)	Do.
Bluefish	Do.
Kingfish	Do.
Stingray (*Myliobatis californicus*)	Do.
Sculpin; bull-head (*Leptocottus armatus* and *Scorpaenichthys marmoratus*)	Do.
Sea bass	July to October.
Spanish mackerel	Do.
Horse mackerel	Do.
Chub mackerel	Do.
Whitefish	April to October.
Yellow-tail	Do.
Smelt (*Osmerus* and *Hypomesus*)	March to November.
Sardine (*Clupea sagax*)	April to November.
Bastard halibut	May to September.
Barracuda	July to November.
Sharks (*Rhinobatus*, *Galeorhinus*, and others)	All the year.
Skate (*Raia inornata* and *R. binoculata*)	Do.
Sea trout (*Hexagrammus decagrammus*).	
Mullet (*Mugil*).	
Pompano (*Stromateus*)	July to September.

The species taken in the hand-line and gill-net fisheries in the winter and spring are chiefly rockfish, flounders, smelts, sharks, kingfish, and sculpins; while barracuda, mackerel, sea bass, bonito, pompano, whitefish, yellow-tail, bastard halibut, horse mackerel, etc., are caught in summer, in addition to the other species just enumerated. Shad are rare in the waters of this county, only one being caught in 1888, but they are plentiful on the north side of Monterey Bay near Santa Cruz.

Sharks of several species are abundant; only the fins and tails are utilized; these are sold to the Chinese for 11 cents per set, or what is obtained from one fish. One swordfish (*Xiphias gladius*) was killed in 1888; the fishermen say this is the only one of this species ever seen or taken at Monterey Bay.

Whales are reported more numerous than they were a few years ago, but no attempt has been made to take them at Monterey Bay since 1881, and the shore whaling station at Carmel Bay was closed three years later. Sea lions are very plentiful in Monterey Bay and vicinity; they can be seen in large numbers at all seasons, hauled out on the rocky shores and ledges about Carmel Bay; they frequently damage nets, but have no commercial value and are not sought by fishermen.

Squid are abundant in their season, and constitute an important object of fishery of the Chinese, by whom alone they are taken. They arrive in large numbers in April and remain about two months. Occasionally a small catch is made in the fall. Shellfish are scarce or entirely absent. There are no scallops and only a few clams and abalones. The latter were once abundant, but are now nearly exterminated, little more than enough being obtained to supply the tourists visiting Monterey. Only a few are sent to San Francisco. There are no shrimp or crayfish taken. Lobsters appear to have been successfully introduced by the U. S. Fish Commission. Mr. Wilcox was told that specimens 4 to 6 inches long were occasionally seen, and that two were taken in February, 1889, which were immediately returned to the water by the fishermen.

Fishing grounds.—The fisheries are prosecuted almost exclusively in Monterey and Carmel Bays. The latter is resorted to by fishermen from Monterey, and especially by the Chinese at Point Alones, who unite their interests with the Chinese fishermen at Pescadero, to the extent at least that the residents of both villages ship their products together to San Francisco.

Mr. Alexander makes the following remarks concerning Monterey Bay in his report on the lobsters planted at that place:

> Stormy weather generally affects the movements of all species of fish in the bay. On the first approach of a storm they leave their favorite feeding grounds and seek deeper water, and do not again enter the bay until several days after the storm has subsided.
>
> During the rainy season a large amount of fresh water constantly flows into the bay, carrying with it mud and other material, which to a marked degree seems to

> have a deleterious effect upon the food fishes, and it frequently happens that two and three weeks will elapse ere fish will again be found in paying quantities.
>
> The day I arrived at Monterey the fishermen had just finished taking up their nets, and they did not put them down again while I was there, but occupied their time in mending and generally overhauling all their fishing gear.

In summer, when the most valuable species are abundant, and when the weather favors their pursuit, the local fishing grounds are utilized to their full extent; but in winter only a small amount of fishing is done, chiefly in the sheltered coves and about the rocky ledges along the shores of Monterey and Carmel Bays. An important trawling ground frequented by the Chinese is near the shore from Point Alones around to Point Cypress. But "all is fish" that comes to these thrifty and industrious gleaners of marine products, and the shores as well as the sea bottom furnish a field for their enterprise. At low tide the coves and uncovered ledges are searched for sea moss, abalone, sea-urchins, or any other products for which a market can be found.

Fishermen.—The fishermen of this county are wholly natives of southern Europe and China, more than half of them being Chinese. The Europeans are chiefly Portuguese and Italians, and a considerable percentage of these have become naturalized citizens of the United States. The Chinese, however, appear to have no desire for citizenship. They live, as a rule, in miserable squalor, in rude board shanties, but nevertheless seem content, and are satisfied with conditions that would be unbearable to white men, particularly those of American birth. The whites work on shares—one share going to the boat. They make a good living and appear thrifty and contented.

Boats.—The boats used by the white men are built in San Francisco, and are less than 5 tons burden; 4 of the largest are feluccas, and 17 carry sprit-sails. The average crew is two persons, but often only one man goes in a boat, while the larger craft usually carry three. There are also 7 rowboats, worth $25 each. The Chinese at Carmel Bay employ a junk of 11 or 12 tons, and 22 skiffs, or sampans, with an average length of about 21 feet.

Apparatus, methods of fishing, etc.—The white fishermen use drag seines, gill nets, and hand lines. Drift nets and set nets are chiefly used in summer, but to a less extent in winter, when hand lines are in most favor. Trawl lines are prohibited.

Alexander says:

> The Chinese pay but little attention to any of the established rules, but persistently fish with trawls and all other gear known to the race; and in consequence of this constant violation of fishing laws there exists a very bitter feeling between the two classes, and frequently severe altercations take place. Notwithstanding complaints are continually being made, no person of influence has ever interested himself enough to try to rectify the wrongs or alleviate the sufferings of the injured class.

The trawl lines used by the Chinese in Monterey and Carmel Bay are rigged with 200 small hooks on each section of ground line, which is coiled in a basket. Each boat carries eight baskets of trawl.

The apparatus and methods employed in the squid fishery are the same in both bays. The fishery is prosecuted at night. Small purse seines are used. These are each 180 feet long, 18 feet deep, with from ½ to 1 inch mesh. A boat with a blazing torch at the bow first starts out and rows slowly around the bay. The object of this maneuver is to attract a large school of squid to the surface, where they can be more easily and surely captured. In company with the boat carrying the torch are two other skiffs, with the seine, their crews eagerly and anxiously watching for the signal that announces a school of squid has been "raised" and are hovering just beneath the surface, in the glow of the light that flares and sparkles in the wind. Instantly, when the signal is given, the seine is thrown out, the fishermen guiding their craft so that the net makes a complete circle around the boat with the light. The seine is quickly pursed up, and its contents are taken into the boats, which return to the shore and land their catch.

The shore whale fishery has been abandoned for several years; the New Bedford fleet having recently resorted to San Francisco to refit, etc., and there having also been a considerable increase in the numbers of whalers from the latter port, the fishermen formerly engaged in shore whaling find it more profitable to go on the vessels, hence the closing of the stations they formerly operated. The station at Carmel Bay remains as it was left, with boats and other fixtures under cover; it is probable that the fishery may be resumed at this station if the price of oil advances and other conditions promise lucrative returns.

Preparation and disposition of products, etc.—The entire catch of the white fishermen and a portion of the products obtained by the Chinese are sold in a fresh condition. Most of the products go to San Francisco, expressed by rail; a comparatively small amount is disposed of locally. No ice is used for their preservation, and, as is generally the case on this coast, the fish are not eviscerated before being sent to market. Here, however, the fishermen have the advantage of living in close proximity to the fishing grounds, and this, together with the facilities for transportation afforded by the railroad, makes it possible for them to put their fish on the market in as good condition as practicable where ice or other means of refrigeration are not utilized.

The Chinese cure quantities of small fish (among which are rockfish, flounders, and perch) that are not sent to market in a fresh state. These are dried round, just as they come from the water; not the least attention is paid to cleanliness. Samples of these seen by the writer had a repulsive odor, and their appearance was anything but attractive as an article of food. Nevertheless, they are in demand in China, where they meet with a ready sale, and are also eaten by the Chinese in the United States.

Squid are cured in a somewhat similar manner. No salt is used on them. The largest specimens are split, washed, and spread on flakes to dry. It requires about two days of fine weather to dry them properly, and they are carefully watched over by those who attend to this work.

Report U. S. F. C. 1888.—(To face page 61.) Pacific Coast Fisheries. PLATE V.

CURING SQUID AT POINT ALONES, MONTEREY.

The small squid are not split or cleaned, but are simply spread out to dry in the same condition that they came from the water.

The Chinese have a large flake yard at Point Alones, devoted chiefly to curing squid. Some of the flakes are placed on the ground, but the majority are elevated on posts 2 or 3 feet high, and resemble the codfish flakes in small fishing towns in New England. Here, in the height of the squid season, may be witnessed a busy scene. The squid are brought from the boats in baskets or whatever other receptacles may be convenient. Here and there are groups of Chinese or single individuals, squatting upon the ground or bending over the elevated flakes, every one actively engaged in spreading the green squid or gathering up those already cured (see plate IV). When dried the squid are packed in bundles and covered with matting, each package containing about 135 pounds and upwards. They are sent by steamer to San Francisco, where some are sold to the domestic trade and the remainder exported to the Sandwich Islands and China.

The products of the abalone fishery are treated in the ordinary manner, the "meats" being dried and the shells prepared for shipment or local sale. Some of the Chinese find employment in gathering and selling to tourists, in addition to abalone shells, all sorts of "sea trinkets," among which sea-urchins and various small shells figure conspicuously.

Sea moss is dried and packed in sacks holding about 147 pounds.

The following tabulated statement, obtained from official records, through the politeness of the transportation companies, shows in detail the monthly shipments of fishery products at Monterey. All such material, except abalone shells and sea moss, is classified under the general term of fish; but as fresh products are shipped by express over the railroad, and all others go by the less expensive steamer route, it is easy enough to separate the fresh fish from the cured.

Monthly shipments of dry and fresh fish from Monterey to San Francisco in 1888.

Month.	Cured fish by steamer.		Fresh fish by railroad.	
	Packages.	Pounds.	Packages.	Pounds.
January	21	2,880	236	80,121
February	9	1,100	241	89,171
March	6	480	618	81,948
April	8	1,400	673	86,940
May	187	25,255	631	110,580
June	780	121,822	822	83,390
July	82	16,215	882	89,508
August	256	31,385	1,207	172,717
September	468	67,690	815	166,461
October	46	5,075	1,068	150,346
November	58	15,595	827	87,856
December	106	15,920	871	78,430
Total	2,015	*296,177	8,361	†1,190,861

---

* Including the weight of 2,015 packing boxes; net weight, 281,147 pounds. In addition to these quantities of fish, 11 sacks of abalone shells, weighing 885 pounds, and 60 sacks of sea moss, weighing 8,820 pounds, were also shipped by steamer.

† Including 269,635 pounds, the weight of 8,361 packing boxes, the net weight of the fish being 921,226 pounds.

The extent of the fisheries in 1888 is shown in the following tables:

Persons employed.

Country.	Nationality.	Nativity.
United States	35	....
Portugal	5	30
Italy	7	17
Spain	4	4
Austria	2	2
China	74	74
Total	127	127

Apparatus and capital.

Designation.	Number.	Value.
Junk (11 tons)	1	*$800
Sailboats, lateen-rigged	4	2,000
Sailboats, sprit-rigged	17	1,400
Small row boats	7	175
Chinese boats	22	4,400
Purse seines	14	3,500
Drag and sweep seines	6	465
Gill nets	80	2,400
Lines (including trawls, with 61,000 hooks)	....	533
Shore property	....	500
Total	....	17,273

* Including outfit.

Products and values.

Species.	Pounds.	Value.
Fresh salmon	5,000	$250
Other fresh fish	946,326	47,316
Dried fish and squid	281,147	14,067
Abalone shells	10,050	515
Total	1,242,523	62,148

19. FISHERIES OF SANTA CRUZ COUNTY.

Geographical features.—The general trend of the seacoast of this county is northwesterly. The shore line is, however, in the form of a reflex curve, its southern end bordering the northern side of Monterey Bay, curving away nearly west to Santa Cruz, where it turns northward. Its length, following the curvature of the coast, is about 40 miles. In some places the shores are low, and the beaches are generally sandy or shaly. Jordan says that "running parallel with and north of the beach are bluffs of considerable height; these in some places are extended as ledges or reefs under the sea." The cliffs facing the sea are in many places wave-worn and vertical or nearly so, offering no shelter or landing place for even the smallest fishing boat.

Fishing centers.—The fishing centers are Santa Cruz and Soquel. Both towns are within easy reach of San Francisco by rail or steamer. The former is a pleasantly situated seaside resort of some note, located on the north side of Monterey Bay, and having in 1888 an estimated population of about 6,000. Its harbor is not good, being open to southerly and westerly storms, and when the wind blows hard from those directions it is impracticable for boats to go out.

The fishing interests of Santa Cruz are controlled by two firms, who own two long piers, which serve the double purpose of fishing stations and steamer landings. In summer the boats usually lay at anchor off the town, when not engaged in fishing, but in fall and winter the weather is more boisterous, and they are always hoisted, at the close of each day's work, to large wooden davits fastened to the sides of the wharves, like the davits on the side of a whale ship. During the prevalence of gales on the coast the sea is so heavy that boats lying at anchor off the town would either founder or drive ashore and be destroyed. It is therefore manifestly necessary to either hoist them in this manner or run them up on the beach out of the way of danger. Wilcox states that both methods are in vogue. One of the Santa Cruz firms—locally called companies—owns 15 boats, and the other has 3. These constitute the entire fleet from this place, since the fishermen own no boats.

Soquel is a small village about 5 miles east of Santa Cruz, on the line of the railroad, near the mouth of Soquel Creek. It has a somewhat better shelter for boats than Santa Cruz, and is therefore a favorite shipping point to San Francisco. It has a fleet of 10 small fishing boats.

In 1878 Aptos, a railroad station 3 or 4 miles east of Soquel, was a fishing center of some note, according to Professor Jordan, who states that "at a point between Soquel and Aptos are about 50 fishermen." In the year mentioned 80,818 pounds of fish were caught at Aptos.* At the present time there is no fishing from Aptos.

Importance of fisheries.—The fisheries of Santa Cruz County are at present unimportant. In 1888 the number of men employed was less than half the number reported for 1878 by Professor Jordan. The products remain essentially the same, however, being 233,831 pounds, net, in 1878, and 235,247 pounds, worth $11,762, in 1888. This would indicate that the men now engaged in fishing give more exclusive attention to it than formerly.

Species, seasons, etc.—For the most part the marine species here are essentially the same as those in the waters of Monterey County. There is, however, an entire absence of abalone and sea moss. Shad and salmon are much more numerous here, and species of fresh-water fish occur that are not found at Monterey or are less plentiful. Shad have annually made their appearance in Monterey Bay for several years past, and occasionally have been quite numerous. They generally arrive in the spring, but there are exceptions to this rule, according to the local fishermen. The season is from March till June. The bulk of the catch is between April 15 and May 15, but occasionally a few are taken as late as October. During 1887 shad were exceptionally abundant, one or two tons being shipped a day. In 1888 the catch was much smaller and not above the average. Salmon occur from March to May, both in the bay and in San Lorenzo Creek, which empties into the harbor of Santa Cruz; they range from 8 to 20 pounds.

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* "The Fisheries and Fishery Industries of the United States," page 606.

Salmon trout, weighing from 5 to 12 pounds, are plentiful in the creek at times during the spring. Brook trout were formerly abundant, but have become scarce from excessive fishing; those remaining weigh from less than a pound to upwards of 4 pounds.

Fishing grounds.—The grounds are near the shore and along the reefs for 10 or 15 miles each side of Santa Cruz. They are much exposed to the south and west, and when the wind blows strong from those quarters the fishing boats can not venture out, for the sea breaks heavily along the coast.

Fishermen, lay, etc.—The fishermen are mostly native Californians. The rest are Portuguese and Italians, all of whom are naturalized citizens of the United States. There is much difference in the economic condition of the fishermen. Those at Soquel own their boats and fishing gear, and share the catch among themselves. At Santa Cruz, however, the boats and all the apparatus are owned by firms, and the fishermen work on a lay. The owners of the boats and outfit receive one-third of the fish taken; the fishermen have two-thirds. Mr. Alexander remarks that "this seems to be a generous lay; but the owners have the privilege of establishing the price of fish at all times." This privilege, he thinks, may account for their seeming liberality. The earnings of the fishermen vary from $18 to $20 per week in summer to $8 or $10 (and sometimes much less) in winter. In the winter of 1889-90 fish were exceptionally scarce and the income of the fishermen was correspondingly small.

Boats.—Most of the boats employed here are feluccas; a few of the smaller class are sprit-rigged. Alexander states that "in size, rig, and general construction they are the same as those of San Francisco." He also mentions the fact that two lateen-rigged boats, each 25 feet long, are employed in summer in fishing with a paranzella.

In the early part of 1889 Wilcox found only 12 fishing boats at Santa Cruz, but the next winter, when it was visited by Alexander, the number had increased to 18.

Apparatus and methods of fishing.—Trawl lines are set along the coast for bottom-feeding species. Hand lines are not extensively used. Gill nets and trammel nets are employed for the capture of several important species, among which may be specially mentioned sea bass, barracuda, salmon, and shad. The sea-bass gill nets are each 120 feet long and 40 meshes deep, the mesh being 8½ inches stretch measure. These nets are made by the fishermen, who obtain their twine principally from Boston, Massachusetts, but some of it is imported from Italy. The imported twine costs 85 cents per pound, the domestic 60 cents. The gill nets used for barracuda fishing are similar to those previously described. They are bought by the fishermen at an average price of 60 cents per pound, including the hanging ropes and corks.

Salmon and shad are also caught in gill nets in Monterey Bay, but Alexander says that the fishermen of Monterey Bay have no gill nets specially designed for catching shad, and fish of this species that are gilled "are taken in nets with a mesh much smaller than the law requires." But the shad are usually found dead after remaining in a gill net for several hours, and the fishermen naturally object to throwing their catch back into the sea to rot or to be devoured by predaceous fish; therefore the shad are taken to market or are otherwise utilized.

The paranzella is employed here in summer, chiefly for the capture of flounders, though red rockfish, crabs, etc., are frequently taken in it. The names "bag seine," "drag seine," and "bag net" are usually applied to the paranzella on the Pacific coast by those unfamiliar with its origin and its European designation. The paranzella consists of a deep, cone-shaped bag of fine-meshed netting, flanked by long narrow wings, the upper edges of which (as well as the bunt) are supported by cork floats, while the lower edges are weighted with lead sinkers so that they will sweep the bottom like the foot line of a beam trawl. It is usually hung so that the net sweeps back in a deep curve between the foot line and the cork rope. The average size of the paranzella used at Santa Cruz is 85 feet long, from end to end of the wings. The bag or bunt is 30 feet in length. When in operation, the cork rope is 6 feet above the foot line, but, measuring the curve of the twine, they are separated 20 feet. There is a 4-inch mesh in the wings and a 2½-inch mesh in the bag. This type of net is used as a drag seine, being hauled on shore, and it is also operated in comparatively deep water some distance from the coast.

Two boats are required for fishing with a paranzella in deep water. A long, stout rope extends from the quarter of each boat to one wing of the net, and they sail along, widely separated but parallel with each other, slowly dragging the apparatus over the bottom. When the end of the ground is reached, or for other reasons the net has been towed long enough, it is hauled in and its contents taken into the boats.

Spears are used to some extent for catching salmon in San Lorenzo Creek. The spears have three barbed prongs, 6 or 7 inches long and 2 inches apart. There is a deep socket above the spearhead and into this is fitted a pole 8 or 10 feet long. A strong line is fastened to the spearhead and passed through rings on the shaft to the hands of the fisherman. When a fish is struck, the spear is detached from the handle and the salmon is pulled in by the line.

Preparation, transportation, markets, etc.—The fishery products of this county are marketed fresh, and are not preserved or in any manner prepared for market. The larger part of the catch goes to San Francisco, but considerable quantities are disposed of in the interior towns along the line of the railroad. Soquel is the favorite shipping point, 138,068 pounds of fish having been sent from there by express in 1888, against 22,179 pounds from Santa Cruz. The local demand at the latter place is considerable in the summer season, and sufficient to utilize most of the fish landed at that point. In 1888 75,000 pounds were disposed of there.

The business of supplying Santa Cruz with fish is controlled by the owners of the fishing boats. Peddlers are sent out to hawk the fish about town, but the contents of their coverless wagons (exposed to the sun, dust, and flies) soon become unattractive, if not repulsive. Fish carts also go to San José and a few suburban towns. A well-conducted fish market is much needed at Santa Cruz. The retail price of fish averages about 6 cents in summer and 10 cents in winter. There is considerable complaint of the high price of fish among the residents of Santa Cruz and contiguous places, but the profits derived from fishing have not yet been sufficient to induce much competition.

Following is a tabulated statement showing the monthly shipments of fish from Santa Cruz and Soquel, as obtained from the records of the Wells, Fargo & Co. Express, which transports all products of this kind sent by rail.

*Monthly shipments of fresh fish from Santa Cruz and Soquel during 1888.**

Month.	Santa Cruz.	Soquel.
	Lbs.	*Lbs.*
January	1,069	1,440
February	1,196	....
March	1,728	670
April	2,667	3,230
May	2,416	18,325
June	898	11,280
July	1,330	15,488
August	4,179	32,960
September	5,300	43,070
October	2,769	8,240
November	1,069	7,436
December	304	6,970
Total	†25,179	‡151,465

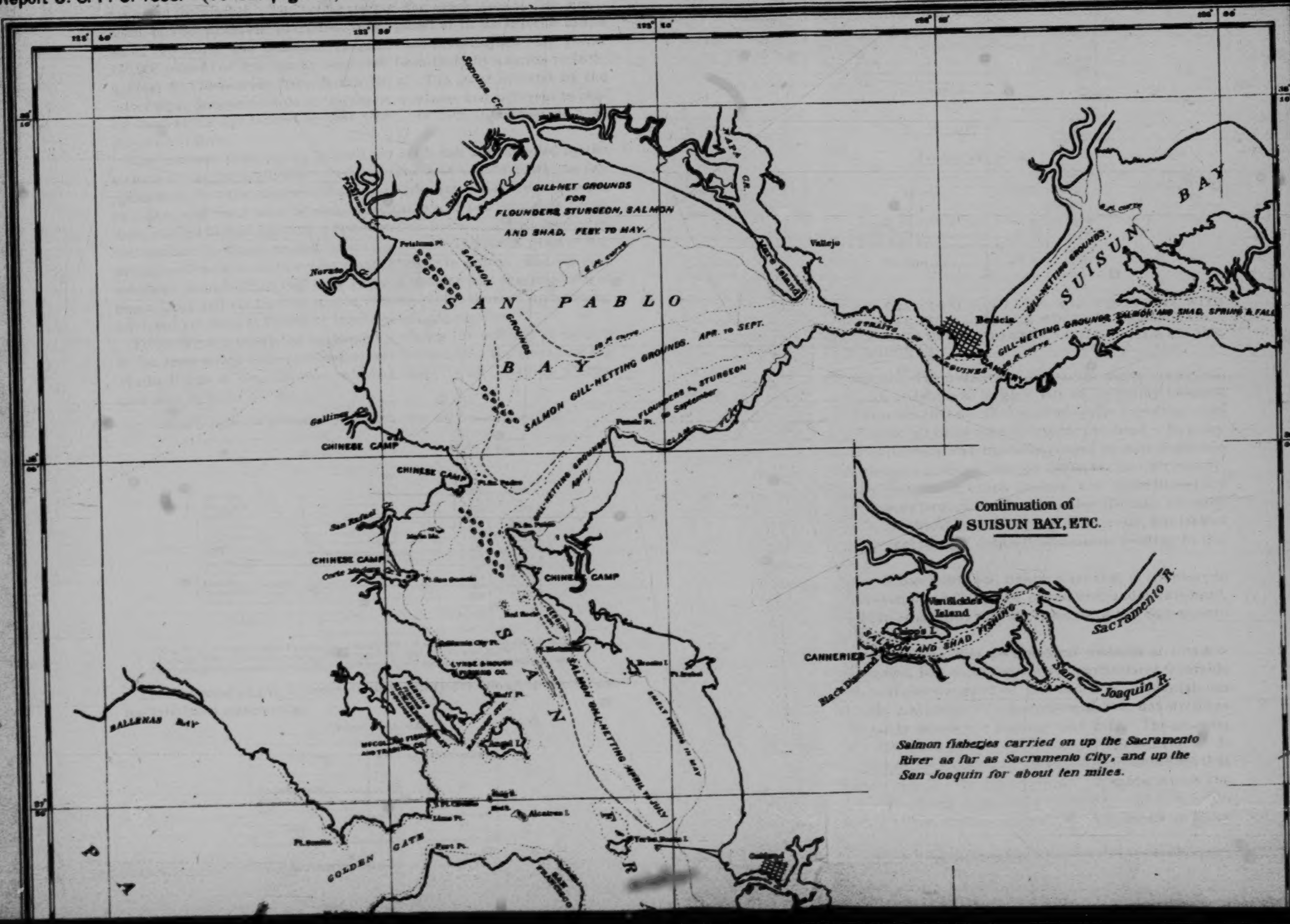
* Nearly all shipped to San Francisco; a small amount was sent to towns on the railroad.
† Includes 3,000 pounds for weight of 500 boxes; weight of fish was 22,179.
‡ Includes 13,396 pounds for weight of 1,300 boxes; net weight of fish, 138,068 pounds.

The statistics of the fisheries of this county are shown in the following tabulated statements:

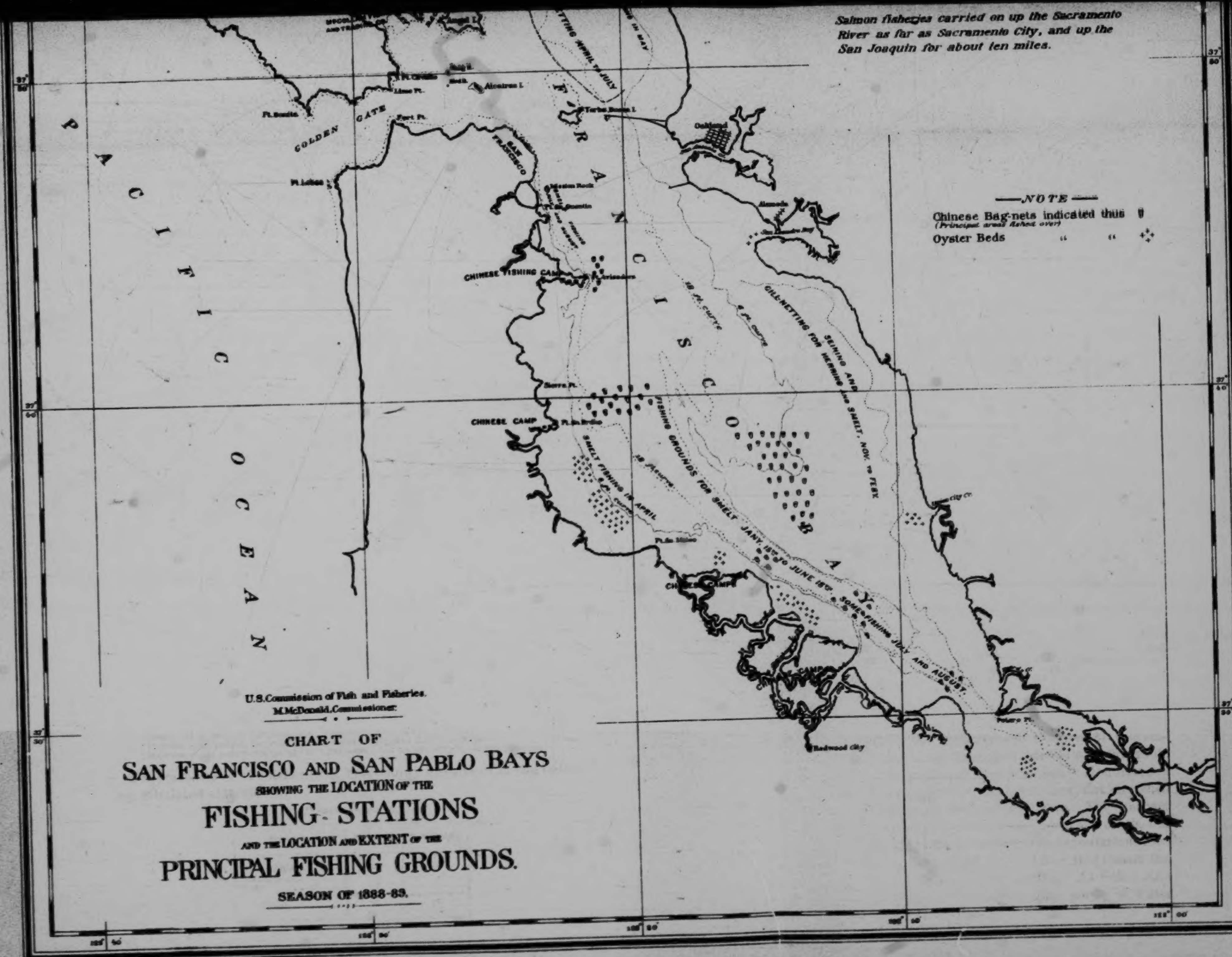
Persons employed.

Country.	Nativity.	Nationality.
United States	15	25
Portugal	7	....
Italy	3	....
Total	25	25

PLATE VI.


Sonoma Cr.
Petaluma
Napa Cr.
GILL-NET GROUNDS FOR FLOUNDERS, STURGEON, SALMON AND SHAD, FEBY. TO MAY.
Petaluma Pt.
Novato Cr.
Mare Island
Vallejo
SALMON GROUNDS
SAN PABLO BAY
6 ft. curve
18 ft. curve
SALMON GILL-NETTING GROUNDS. APR. TO SEPT.
FLOUNDERS & STURGEON to September
CLAM FLATS
Gallinas Cr.
CHINESE CAMP
CHINESE CAMP
Pt. San Pedro
GILL-NETTING GROUNDS April
San Rafael Cr.
CHINESE CAMP
Corte Madera Cr.
Pt. San Quentin
CHINESE CAMP
Red Rock
SAN FRANCISCO BAY
Sausalito City Pt.
LYNDE & HOUGH FISHING CO.
Bluff Pt.
Angel I.
McCOLLUM FISHING AND TRADING CO.
Brooks I.
Pt. Isabel
SALMON GILL-NETTING APRIL TO JULY
SMELT FISHING IN MAY
BALLENAS BAY
PA
Pt. Bonita
Lime Pt.
Alcatraz I.
GOLDEN GATE
Fort Pt.
SAN FRANCISCO
Yerba Buena I.
Oakland
STRAITS OF CARQUINES
Benicia
CANNERY
6 ft. curve
GILL-NETTING GROUNDS
SUISUN BAY
GILL-NETTING GROUNDS SALMON AND SHAD, SPRING & FALL
Continuation of SUISUN BAY, ETC.
Van Sickle's Island
Chipps I.
CANNERIES
Black Diamond
SALMON AND SHAD FISHING
Sacramento R.
San Joaquin R.
122° 40'
122° 30'
122° 20'
122° 10'
122° 00'
38° 10'
38° 00'
37° 50'

Salmon fisheries carried on up the Sacramento River as far as Sacramento City, and up the San Joaquin for about ten miles.


PACIFIC OCEAN
SAN FRANCISCO BAY
GOLDEN GATE
SAN FRANCISCO
Pt. Bonita
Lime Pt.
Pt. Cavallo
Angel I.
Alcatraz I.
Fort Pt.
Pt. Lobos
Yerba Buena I.
Oakland
Alameda
San Leandro Bay
Mission Rock
Pt. San Quentin
CHINESE FISHING CAMP
Pt. Avisadero
Sierra Pt.
CHINESE CAMP
Pt. San Bruno
Pt. San Mateo
CHINESE CAMPS
Redwood City
Potrero Pt.
SETTING APRIL TO JULY
IN MAY
18 ft. curve
6 ft. curve
GILL-NETTING FOR HERRING AND SMELT, NOV. TO FEBY.
SEINING AND
FISHING GROUNDS FOR SMELT JANY. 15th TO JUNE 15th. SOME FISHING JULY AND AUGUST.
SMELT FISHING IN APRIL
18 ft. curve
6 ft. curve
37° 50'
37° 40'
37° 30'
122° 40'
122° 30'
122° 20'
122° 10'
122° 00'

Salmon fisheries carried on up the Sacramento River as far as Sacramento City, and up the San Joaquin for about ten miles.

—*NOTE*—

Chinese Bag-nets indicated thus ⬮
(Principal areas fished over)
Oyster Beds " " ⁘

U.S. Commission of Fish and Fisheries.
M. McDonald, Commissioner.

CHART OF
SAN FRANCISCO AND SAN PABLO BAYS
SHOWING THE LOCATION OF THE
FISHING STATIONS
AND THE LOCATION AND EXTENT OF THE
PRINCIPAL FISHING GROUNDS.
SEASON OF 1888-89.

Apparatus and capital.

Designation.	Number.	Value.
Boats	20	$10,700
Gill nets	110	4,400
Bag nets	6	750
Trawl lines, spears, etc		910
Shore property		650
Total		17,410

Products and values.

Species.	Pounds.	Value.
Salmon, fresh	15,000	$730
Shad, fresh	20,000	1,400
Other fresh fish	200,247	9,612
Total	235,247	11,762

20. FISHERIES OF SAN FRANCISCO, SAN PABLO, AND SUISUN BAYS, WITH ADJACENT SEACOAST, INCLUDING THE COUNTIES OF SAN MATEO, SAN FRANCISCO, SANTA CLARA, ALAMEDA, CONTRA COSTA, SOLANO, SONOMA, AND MARIN.

General considerations.—The fisheries of this entire region are so intimately associated with and form so large a part of the fishing business of the city of San Francisco that no other method seems expedient than to discuss the interests of all these counties under one head. In many cases firms with headquarters and business houses at San Francisco have curing establishments at some point on the bay in another county, while the same is true concerning oyster-dealers, who trade in the city and have their oyster beds located 10, 15, or 20 miles distant. In many other ways there is an inextricable commingling of interests, but lack of space prevents the presentation of detailed statements relating to this matter.

The salmon fishery on San Pablo and Suisun Bays that is tributary to the canneries in the vicinity will not be considered under this head, but will be discussed in connection with the fisheries of the Sacramento and San Joaquin Rivers.

Geographical characteristics.—The geographical features of this section are extremely varied, but on the whole are particularly favorable to the prosecution and development of the fisheries. Mountainous shores, bold headlands, and steep cliffs alternate with low, flat stretches of coast fringed by sandy beaches or areas of mud flats. The seacoast south of the Golden Gate has a general trend nearly north and south. It is high and bold, and, with few exceptions, there are no indentations that afford even temporary shelter for fishing boats. For this reason the coast is dangerous when strong gales occur in winter. At Point Año Nuevo boats sometimes find shelter; Half-moon Bay, south of Pillar

Point (17 or 18 miles south of the Golden Gate), affords anchorage in northerly or easterly breezes; and about 6 miles farther north, under Point San Pedro, boats may ride in southerly or easterly winds. However, this is only about 10 miles from Point Lobos, and with such winds boats can soon run up to San Francisco.

North of the Golden Gate the coast of Marin County extends west-northwesterly to Point Reyes, where it turns abruptly northward, its general course thence being nearly north to its junction with Sonoma County, which stretches away to the northwest, its shores unbroken by any important bays or harbors. From a fishery standpoint Sonoma County is chiefly noteworthy for Russian River, a salmon stream of some importance. In Marin County, Drake's Bay affords excellent shelter in most winds and is a noted fishing ground at all seasons. Bodega Bay, west and south of Bodega Head, is connected with Tomales Bay, which extends inland in a southeasterly direction about 17 miles, and has a width varying from about one-third of a mile to upwards of a mile. It is one of the best fishing localities along the seacoast of the State.

Entering the Golden Gate we come upon the broad, well-sheltered waters of San Francisco Bay, stretching from Santa Clara County on the south, in a north-northwesterly direction, to Point San Pablo and Point San Pedro, a distance of about 38 miles, its width varying from 1 to 11 miles. Its shores are much diversified by hills and flat marshes, irregular in outline, with many coves, small bays, projecting points, and islands. Here, on the west side of the bay, opposite Oakland and Yerba Buena Island, and near the Golden Gate, is the important city of San Francisco, and at other points are situated fishery centers, curing stations, etc., that will be more specifically mentioned in subsequent pages. Over a very considerable part of the bay, and particularly on the east side, the water is shallow, being less than 18 feet, while a large area has a depth of only 6 feet or less.

Passing through the narrows between Point San Pedro and Point San Pablo, we enter San Pablo Bay, a broad, shallow, nearly pear-shaped estuary, with rather irregular shores. Its greatest diameter is a little more than 11 miles, and its average width is approximately 7 miles. Several streams flow into it, among which may be mentioned Napa Creek, Sonoma Creek, Petaluma Creek, Novato Creek, and Gallines Creek. It is connected with Suisun Bay on the east by the Strait of Carquinez, which is nearly 4 miles long, with a good depth of water. Suisun Bay is small and shallow, with the exception of the channels resulting from the inflow of the Sacramento and San Joaquin Rivers, and other minor streams that enter it on the north and east. Its extreme length is about 10 miles; it is about half as wide, but in the east end and middle of the bay are many islands, several of them of large extent, that restrict the water area materially.

Importance of the fisheries.—The marine fisheries of this region, particularly those which center at San Francisco, are very important, and probably exceed in magnitude the combined value of all other similar fisheries along the entire coast of the Pacific States from San Diego to Puget Sound, including those localities. In addition to the local or shore fishery prosecuted from boats, etc., and which of itself is a large industry, San Francisco is extensively interested in the pursuit of the cod, whale, and fur-seal fisheries, which employ large numbers of men and much capital, while the products reach an aggregate value of considerable magnitude. The river or fresh-water fishery is of secondary importance, and, though not insignificant, it can not be favorably compared with the immense operations on the Columbia River, or even with those prosecuted on streams of less consequence. Nevertheless, considerable quantities of anadromous species, and notably the salmon, are taken in the bays, when the fish are en route to their breeding-grounds. As a whole, San Francisco and vicinity may be considered one of the leading fishery centers of the United States, and its possibilities of development in this particular are believed to be very great.

Because of their magnitude the fisheries of this region will be considered separately.

Fishing centers.—The city of San Francisco is the great fishing center of this region and as a market and point of distribution maintains fisheries at other points in its vicinity. The varied character and importance of its fisheries will appear in the detailed discussions that follow; there also will be found extended reference to the fleets of vessels and boats that sail from this port, or bring hither their products for sale or shipment. The New England whalers that hunt their prey in the icy Arctic Ocean north of Bering Strait come to San Francisco in fall and winter to land their catch and refit for other cruises.

The fisheries of San Francisco have built up in the city several manufacturing enterprises, while the disposal of fishery products employs a considerable amount of capital and many people. Four firms are engaged in the manufacture and sale of fishing apparatus, and, in addition to supplying the local demand, they ship goods to other points along the coast from Panama to British Columbia, while occasional invoices are sent to the Pacific Islands. It is estimated that fully 40,000 pounds of cotton rope and "hanging twine" of American manufacture are annually sold to the fishermen and canneries of British Columbia, while some 36,000 pounds of trap netting, valued at about $15,000, are exported to Panama and one or two of the Pacific Islands.

The importance of San Francisco as a fishing and distributing center is best shown, perhaps, by a consideration of exports and imports of fishery products. In 1888 the exports of cured cod, canned, salt, and smoked salmon, other species of canned or cured fish, crustaceans, and shellfish amounted to $2,711,377. The exports of whale and fish oils for the same year, according to the custom-house records, aggregated $64,634. In 1886 the collector of the port, Hon. John S. Hager, reported the imports of "all other dutiable fish, $66,665." These fish came chiefly from China, and were for the Chinese trade of California.

The following tables show in detail the export trade of the city:

Exports of fishery products from San Francisco during the year 1888.

Countries to which exported.	Codfish, cured.		Other cured fish.		Canned salmon.		Pickled and smoked salmon.	Other canned fish.	Oysters.	Other shell-fish and crustaceans.*	Total value of exports.
	Lbs.	*Dolls.*	*Lbs.*	*Dolls.*	*Lbs.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*
Great Britain					18, 054, 804	2, 054, 383					2, 054, 383
Australia	607, 910	26, 511	12, 000	516	2, 940, 320	240, 413	11, 283		44	[illegible]	282, 032
British Columbia	9, 300	607	8, 700	476			60	197	5, 997	1, 534	[illegible]
British East Indies	17, 250	1, 127	7, 000	390	24, 000	3, 035		314		85	4, 951
French possessions	9, 960	571	1, 000	50	25, 400	3, 603	1, 780	372	[illegible]	447	7, 075
Germany										100	100
China	43, 450	2, 351	297, 010	16, 878	121, 304	14, 746		220	176	[illegible]	199, 749
Japan	7, 000	463	28, 300	1, 307	21, 393	2, 563		105	63	730	6, 457
Russia										24	24
Mexico	12, 915	722			27, 675	3, 028		1, 027	1, 034	960	6, 771
Costa Rica	2, 000	146			23, 350	2, 361		643	120	108	3, 378
Ecuador								66	65		131
Guatemala	17, 630	1, 163			4, 440	512	60	290	312	100	2, 437
Honduras								108	22		130
Nicaragua	240	16			1, 450	172		323	184		695
San Salvador	1, 300	78			2, 073	233		188	325	130	954
U. S. of Colombia					57, 820	6, 479	177	77		[illegible]	8, 329
Chili										7, 771	7, 771
Hawaiian Islands	204, 130	12, 816	306, 737	27, 195	163, 041	15, 109	22, 705	2, 307	6, 167	29, 375	108, 643
Other islands and ports	1, 000	57			40, 290	5, 014	2, 034	267	133	162	8, 047
Total	790, 625	48, 153	658, 657	46, 902	20, 625, 256	2, 353, 216	40, 080	7, 432	14, [illegible]	201, 692	2, 711, 977

* These consisted mostly of abalone and shrimp, the largest part being shrimp exported by the Chinese to Hongkong and the Sandwich Islands. Squid is included under "other cured fish," it being impossible to secure separate figures for that mollusk from the custom-house records.

Exports of whale and fish oil from San Francisco during 1888.

Whither sent.	Sperm oil.		Whale and fish oil.	
	Galls.	*Dolls.*	*Galls.*	*Dolls.*
Australia			44, 310	12, 370
England			71, 405	18, 569
France			147, 257	33, 138
Hongkong			17, 007	4, 876
Hawaiian Islands	500	360	1, 061	312
Mexico			5, 302	1, 300
Philippine Islands			496	99
Total	500	360	287, 078	64, 624

Monthly exports of fishery products from San Francisco, exclusive of salmon, in 1889.

Month.	Codfish.		Minor species of fish, squid, etc.		Value of oysters.	Value of abalones and shrimp.	Total value of exports.
	Pounds.	Value.	Pounds.	Value.			
January	72, 062	$4, 293	50, 700	$3, 223	$1, 000	$13, 263	$22, 797
February	95, 000	6, 000	40, 300	2, 000	1, 110	28, 300	37, 569
March	113, 910	7, 144	23, 300	1, 522	1, 207	19, 363	29, 241
April	59, 790	3, 516	15, 000	778	1, 105	13, 663	19, 061
May	65, 360	4, 048	44, 115	2, 627	1, 767	18, 500	27, 000
June	37, 700	2, 000	245, 230	14, 307	1, 350	41, 278	59, 100
July	39, 400	2, 100	46, 300	1, 500	1, 615	18, 087	24, 358
August	33, 720	2, 201	143, 400	8, 623	2, 130	37, 914	50, 277
September	54, 935	3, 401	42, 000	2, 300	1, 450	17, 300	24, 568
October	57, 620	3, 545	83, 180	4, 065	2, 217	26, 183	36, 010
November	55, 040	3, 000	37, 750	2, 070	1, 505	11, 201	19, 294
December	60, 470	3, 620	23, 830	1, 580	2, 120	8, 650	16, 001
Total	790, 717	46, 945	814, 865	48, 011	*20, 027	250, 951	361, 734

The exports of canned salmon amounted to [illegible] cases, valued at about $[illegible].

The products mentioned in the first table under the caption of "other cured fish" (amounting to $46,902) are composed chiefly of salted and dried bonito and barracuda, which, prepared in this way, are dark-colored like ordinary smoked fish, and have a rather strong odor. They are mostly shipped to the Hawaiian Islands, and are also in favor among Italians, Portuguese, and Chinese. "Shellfish and crustaceans" are mostly shrimp and dried abalone, which go largely to China. A considerable portion is the product of the junk fishery, and includes dried oysters obtained on the coast of Lower California or Mexico.

There is considerable "shore property" at San Francisco utilized in connection with the fisheries. The wharves, storehouses, etc., used for the market fishery will be mentioned in discussing that industry.

There are no important fishing centers in this region south or east of San Francisco; a Chinese fishing camp is, however, located at Point Avisadero, San Francisco County. On the southwest side of the bay, in San Mateo County, are three other Chinese camps; one is at Point San Bruno, 8 or 9 miles south of San Francisco; another is about 8 miles farther off, nearly 3 miles southeast of Point San Mateo; the third is located near the mouth of Redwood City Creek. There are no fishing stations of special importance on the seacoast of San Mateo County, nor has Santa Clara County any fishery, though it borders the extreme south end of San Francisco Bay.

The fishing grounds near the shores of Alameda County are frequented by boats from other sections of San Francisco Bay, but there is no point in the county from which any commercial fishery is prosecuted. Indeed, profitable fishing is impracticable, for the shore at low tide is mostly a wide stretch of uncovered mud flats with no suitable landing for fishing boats.

A fine quality of salt used in the fisheries is made by natural evaporation from water brought to the salt marshes of the county from San Francisco Bay. It is preferred to any imported salt and exclusively used for fish-curing purposes. Packed in bags holding about 120 pounds each, it sells for from $7.50 to $8.50 per ton.*

There is a Chinese fishing camp about 2 miles south of Point San Pablo, in Contra Costa County. Aside from this there are no fishing stations in this or Solano County, except those devoted chiefly to the salmon fishery at Black Diamond, Benicia, and Chipp's Island, which will be considered in connection with the fisheries of the Sacramento and San Joaquin Rivers.

Sonoma County has no important fisheries except those of Russian River.

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*An analysis made by W. T. Wensell & Co., of San Francisco, showed this salt to consist of the following constituents: Chloride of sodium (pure salt), 99.063; carbonate of soda, .011; sulphate of soda, .012; chloride of calcium, .052; sulphate of magnesia, traces; oxide of iron, .002; water, .860.

In Marin County, on San Francisco and Richardson's Bays, are the important curing stations of California City and Pescada Landing; and north of the former, at Point San Quentin, Point San Pedro, and 2 or 3 miles northwesterly from the latter, are Chinese fishing camps. On the seacoast the chief fishing centers are Fisherman's, Marshall, Hamlet, Tomales, and Point Reyes, on or near Tomales or Bodega Bays and on the line of the North Pacific Coast Railroad. Sausalito, the southern terminus of this road and just across the Golden Gate from San Francisco, is an unimportant fishing point.

Fishing grounds.—The fishing grounds resorted to by the fishermen of San Francisco and vicinity cover an immense area, and are as varied in character and geographical location as the fisheries prosecuted upon them. They will be alluded to here only in a general way, as the limits of this review preclude extensive details.

Pelagic fur-sealing is prosecuted in the open ocean off the coasts of the Pacific States (at varying distances from the land, but generally not exceeding 150 miles), thence along the coasts of British Columbia and Alaska. Seals are also followed into Bering Sea; but this ground can not be legally resorted to for pelagic sealing. The Pribilof Islands (St. Paul and St. George) have for many years been the most important ground in the world for the capture of fur seals. The right to take seals here (100,000 skins per year) has been controlled by the Alaska Commercial Company, of San Francisco, under a 20-year lease (expiring in 1889) from the United States Government.

There is no systematic fishery for hair seals, sea lions, or walrus, but these are occasionally taken by fishermen sailing from San Francisco or by natives who hunt or fish in Alaskan waters for the large firms having their headquarters in this city. Since the capture of these animals is a mere incident of fishery, so far as this locality is concerned, and as a discussion of the northern grounds frequented by them belongs more properly to a consideration of the Alaskan fisheries, it only seems necessary here to mention the fact that the Farrallone Islands, off the mouth of the Golden Gate, and about 23 to 27 miles distant, seaward, are noted for having extensive rookeries of sea lions (*Zalophus californianus* and *Eumetopias stelleri*), among which the southern species (*Z. californianus*) largely predominates.

The sea-otter fishery, which is practically under the exclusive control of capitalists in San Francisco, is carried on about the islands, ledges, and in the waters of Alaska.

Bering Sea and the Arctic Ocean north of Bering Strait are chiefly resorted to by the whalemen, though whales are also taken on some of the Pacific grounds and in the Japan and Okhotsk Seas.

The Japan ground, which embraces the region "from the coast of Japan southeast to the Bonin Islands, across to 105° west longitude," is occasionally resorted to, but the Okhotsk Sea is more commonly visited by whalers and is next in favor to the Arctic Ocean. In the season of

1889 40 of the fleet cruised in Bering Sea and the Arctic Ocean; the others fished exclusively in the Okhotsk and Japan Seas. Seventy-one whales were taken by the Arctic fleet, and 76 by vessels cruising on the last-mentioned grounds.

The most noted cod-fishing grounds are the banks in the Okhotsk Sea, in Bering Sea, and close inshore about the Shumagin Islands. Recently, in the summers of 1888 and 1889, the U. S. Fish Commission steamer *Albatross* discovered and investigated large areas off the Alaskan coast that are excellent cod-fishing grounds, while others heretofore known to exist have been surveyed and their value determined by extensive research.*

The shore or local fishing grounds of San Francisco and vicinity are extensive and important. The region about the Farrallone Islands is a noteworthy fishing ground, nearly 20 miles long, with an average width of about 6 miles. Over a large part of this area trawl-line fishing is pursued by the San Francisco market boats; the same boats fish along the coast south of the Golden Gate from April to October; their principal ground for trawl-line fishing begins about 6 or 7 miles south of Point Lobos and extends to Pigeon Point, about 30 miles further south. Occasionally a boat goes as far as Monterey Bay. Between Duxbury Point and Bodega Head, along the coast north of the Golden Gate, is a favorite fishing ground for the San Francisco market fleet, as well as for the local fishermen; trawling is pursued here throughout the year. Drake's Bay is a good locality for gill-net fishing for smelt, herring, and perch. Tomales Bay is one of the best fishing grounds on the coast. Russian River, about 15 miles farther north, is a salmon and trout stream of some importance.

Practically the entire area included within the boundaries of San Francisco, San Pablo, and Suisun Bays is fishing ground, upon which many species of fish, crustaceans, mollusks, etc., are taken, and almost an endless variety of apparatus and methods are employed. Over a considerable portion of each of these bays the water is shallow, being within the 6-foot curve; the area between this and the 18-foot curve is comparatively small, while the channel, with a depth exceeding 18 feet, is extensive in dimensions and affords ample opportunity for navigation by vessels of large size as well as a suitable depth for prosecuting certain fisheries. At the south end of San Francisco Bay, and in coves on the west side, 10 to 15 miles south of the city, are important oyster beds, which will be referred to further under the head of the oyster fishery.

The map, plate VI, shows the principal localities for fishing in these bays at different seasons, and with various forms of apparatus. For this reason it is not considered necessary to enter into greater descriptive details.

Vessels and boats.—In 1888 the fleet of fishing vessels sailing from San

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* For more extensive details see vol. VIII, Bulletin U. S. Fish Commission, 1888; also notes on cod fishery in this review.

Francisco, including those used as transports in the cod, salmon, and oyster fisheries, numbered 71, with an aggregate net tonnage of 11,620.65; manned by 1,451 men. Of these, 12 vessels, with a tonnage of 630.52, were engaged in pelagic sealing, sea-otter hunting, and the capture of walrus; 28 vessels (of which 8 were steamers), with an aggregate tonnage of 8,278.46, were employed in the whale fishery. In the cod fishery there were 2 barkentines, with a combined tonnage of 623.41 tons, that went to the Okhotsk Sea, and 7 vessels, of 1,075.31 tons, that fished about the Aleutian Islands, in Bering Sea, or acted chiefly as transports. Three sloops, averaging about 13 tons each, and three sailboats transported oysters from the beds in the San Francisco Bay to the city; two were also used for other purposes in connection with the salmon fishery. In addition to the vessels a fleet of 429 boats of less than 5 tons each are employed in the shore fisheries of this region, many of these being feluccas.

THE WHALE FISHERY.

Importance, etc.—The whale fishery prosecuted from San Francisco is now an important industry. Its development in the last decade has been most remarkable, and is in striking contrast to the marked decline of the fishery from New England ports. This clearly illustrates the advantages San Francisco has for controlling the industry, so long as the chief whaling grounds are in the Arctic Ocean, north of Bering Strait, along the northeastern coast of Asia, and in the northern Pacific.

Clark notes that there were only 3 vessels engaged in the North Pacific whale fishery (including the Arctic Ocean) from San Francisco in 1879. Their aggregate tonnage was 1,470. In 1888 the San Francisco whaling fleet numbered 28 vessels, with an aggregate tonnage of 8,278.46 tons, manned by 932 officers and seamen. Of these, 8 were steamers with a tonnage ranging, for each vessel, from 250 to 800 tons; 14 were barks, averaging upwards of 300 tons each; and there were 1 brig and 5 schooners. Of this fleet, 3 barks fished in the Okhotsk and Japan Seas, and all the rest went to the Arctic Ocean. The fleet included two "tenders," the steamer *Jeanie* and the bark *Thomas Pope*. In 1889 there were 26 vessels actually engaged in whaling, exclusive of 2 tenders. Of these there were 7 steam-whalers, 12 barks, 1 brig, and 6 schooners, the whole having a value, with outfit, of nearly $940,000.

It is as true now as in 1880 that "the interest of San Francisco in the whale fishery can not be measured by the number of vessels owned there, for almost the entire North Pacific and Arctic fleets are accustomed to make that place a fitting port and the headquarters for reshipment of oil and bone to the Atlantic seaboard."[*] The facilities for shipment afforded by the transcontinental railroads have had a marked influence on the industry in San Francisco, and from being a place where whale ships were only occasionally seen, it has become the greatest whaling rendezvous of the world.

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[*] The Whale Fishery, by A. Howard Clark, in "The Fisheries and Fishery Industries of the United States."

Fishermen, lay, etc.—The crews of the Pacific whalers are exceedingly heterogeneous in their make-up. Representatives of nearly every State and Territory in the Union, of the various European nationalities, of Canada and South America, together with natives of the Pacific Islands, Asia, and Africa, may be found on board the whaling vessels. Together they constitute perhaps the most cosmopolitan assemblage to be found in a single industry anywhere on the globe.

Nationality and nativity of persons employed in the Pacific and Arctic whale fishery from San Francisco in 1888, including the crews on New Bedford vessels making their head-quarters on the Pacific coast.

Country.	Nationality.	Nativity.
United States	1,019	727
British Provinces	248	236
Central America	3	8
South America	33	34
Mexico	5	5
Norway	53	42
Sweden	46	66
Denmark	10	11
France	20	26
Germany	91	127
Holland	7	7
Austria	3	3
Belgium	2	2
Italy	3	2
Switzerland	1	1
Russia	12	16
Spain	60	66
Portugal	85	195
Africa	1	1
China	3	2
Japan	28	28
Sandwich Islands	19	21
South Sea Islands	17	20
Total	1,795	1,795

Citizenship of native-born Americans engaged in the Pacific and Arctic whale fishery from San Francisco in 1888, including the crews on New Bedford vessels making their head-quarters on the Pacific coast.

State or Territory.	No.	State or Territory.	No.
Alabama	2	Montana	1
Alaska	2	New York	120
Arizona	3	New Jersey	11
California	64	New Hampshire	4
Connecticut	30	North Carolina	3
Delaware	3	Nevada	3
District of Columbia	1	Nebraska	3
Georgia	2	Ohio	30
Illinois	28	Oregon	3
Indiana	4	Pennsylvania	67
Iowa	11	Rhode Island	13
Kansas	4	South Carolina	1
Kentucky	6	Texas	4
Louisiana	5	Tennessee	2
Maine	20	Vermont	6
Massachusetts	123	Virginia	7
Maryland	11	Wisconsin	13
Michigan	12	Washington	1
Missouri	10		
Minnesota	6	Total	727
Mississippi	3		

The remarkable fact that so many men from interior States have found their way into this fishery illustrates not only the restlessness of Americans, but suggests something of the manner in which crews of whaling vessels are collected at San Francisco and the total lack of experience of some of the men.

The San Francisco Chronicle of January 23, 1887, states:

> In hiring sailors and officers for whaling voyages, the services of men designated as shipping masters are called into requisition. Various systems are resorted to to obtain men. Plying with liquor of the vilest description, doling out sufficient money to enable them to keep within the clutches of the harpies who float around the Barbary coast and water-front region, and in some cases conveying desirable men into interior towns until the ship is ready to sail, are the methods in vogue. The classes of men composing the crews are of a most heterogeneous description; men who have never seen the sea, and to whom a ship is as unfamiliar as a rhinoceros, are to be found on board of a whaler.
>
> Besides these classes a whaling vessel has for a crew some of the greatest drunkards to be found in a large city, jail-birds, and thieves. In this mass of humanity, gathered within the confines of a forecastle, good leaven is small. The majority of those who can pull a boat at the outset of a whaling voyage are Kanakas, natives of the Caroline Islands, or men from the Azores. This class of men regard whaling as a profession.
>
> The lower grades of officers, such as boat-steerers and boat-headers, are nearly all colored men or Portuguese from Cape de Verde Islands. As is usual with ignorant persons placed in authority, their treatment of green hands before the mast is anything but kind. The mates and masters on the vessels are, with few exceptions, Americans, hailing from New Bedford or other Eastern whaling ports. Many instances are made public of the cruelty with which the sailors are treated by these officers, but while there are, no doubt, occasions when brutality is displayed, in most cases the sailors' treatment is aggravated by their own conduct. When it is remembered that the crews of whaling ships are composed partly of a useless set of men and partly of a lot of vagabonds who speedily demoralize the others, it must be conceded that a strong hand is required to keep order and preserve discipline.

The statements above quoted may be a little overdrawn so far as their general application to the whale fishery is concerned, but they are justified by conditions which too frequently exist in connection with this industry. Still it is but just to say that much of this is unavoidable, and while other and more commendable conditions are desirable, it will be conceded that any useful employment of those who otherwise might be idle or worse must be considered of great importance, particularly when this results in the maintenance of an extensive industry.

The men are shipped on shares, as usual in the whale fishery, and they receive "long" or "short" lays, in proportion to their skill and experience. A considerable percentage of the men reship each season and because of their experience often receive better lays than those not previously employed in the fishery. But many merchant sailors or others are shipped who know nothing of whaling; their lay is usually so "long" that they must be very "lucky" to earn more than enough to "square-up" at the end of the season, since the advance received before sailing and "slop-chest" charges during the voyage are generally equal to or in excess of their earnings; indeed, the general rule among the old hands is to secure all the advance possible before sailing, and to draw upon the "slop-chest" during the cruise as much as they are allowed to, for the majority of them think they will get nothing for their trip except the single dollar at the close of the season for "signing clear." The lay of officers, and particularly of the captain, depends largely upon their skill or success in capturing whales, but it is also influenced by the size of the vessel and the number of men in her crew; the lay on a large ship with a numerous crew is considerably "longer" than it is on a smaller craft with fewer men.

The "lay," as stated, shows the proportional part of the catch received by each individual who "signs articles." Thus a one-tenth lay—which is a very "short" one—signifies that the person who "signs" for it is to receive one-tenth of the proceeds of the voyage, while one who had a one-hundred-and-seventieth lay receives only that proportion of the catch, or one-seventeenth of the amount obtained by him who has the shorter lay of one-tenth.

The lays given to the officers and men are generally as follows: Captain, $\frac{1}{10}$ to $\frac{1}{16}$; chief mate, $\frac{1}{16}$ to $\frac{1}{25}$; second mate, $\frac{1}{18}$ to $\frac{1}{30}$; third mate, $\frac{1}{30}$ to $\frac{1}{50}$; fourth mate, $\frac{1}{40}$ to $\frac{1}{60}$; carpenter, $\frac{1}{70}$ to $\frac{1}{150}$; cooper, $\frac{1}{80}$ to $\frac{1}{100}$; cook, $\frac{1}{75}$ to $\frac{1}{150}$; steward, $\frac{1}{80}$ to $\frac{1}{125}$; blacksmith, $\frac{1}{150}$ to $\frac{1}{160}$; donkey engineer on sailing ships, $\frac{1}{100}$ and $10 per month; seamen, $\frac{1}{175}$ to $\frac{1}{200}$. The first engineer on steam whalers gets $50 per month and $\frac{1}{25}$ lay; second engineer, $25 per month and $\frac{1}{100}$ lay; and the firemen, $\frac{1}{125}$ lay.

A peculiar feature of this lay system is that the men agree upon a certain price for the oil and bone before sailing, this price being stated or fixed by the owners, and ordinarily amounting to only about half of what the products are actually worth. Wilcox learned that the price agreed upon is the basis for estimating the value of whale products in submitting returns to the customs officials, the result being that the figures are grossly erroneous.* This system of fixing prices, of course, makes the earnings of the whalemen much less than they actually would be if full market value was the basis of settlement. It is more than probable that if the full market value of the products was paid the lay would be proportionately "longer," so that the men would receive no more than now for their labor.

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* Writing from San Francisco concerning this matter, under date of January 25, 1889, Wilcox stated that the returns sent in by him were made up from the books of owners and agents, and from personal interviews with them. He called attention to the fact that the custom-house returns placed the value of whalebone at $1.50 per pound, while he gave it as $3 per pound. The former was the price agreed upon by the sailors in signing shipping articles for the voyage, and the latter was from 25 to 50 cents less than the market value, but used as the most correct basis for getting actual values after allowing for culls and shrinkage, both of which must be taken into account as materially affecting receipts. The price of whale oil as given to the custom-house was 18 cents per gallon, but it was really worth 35 cents. Thus there was a difference of $553,365 in the value of whale products as furnished to customs authorities and the correct figures.

It should be borne in mind, however, that the owners in fixing the rates take the risk of any fall in the market value of the products by assuring a stated price to the men. While the chances are generally in their favor, they may meet with a loss by a sudden decline in the price of bone and oil. It should also be taken into consideration that not unfrequently vessels return without having captured a single whale, or they may be crushed in the ice, and with their cargoes and outfits become a total loss. The owners of the whaling ships, as a rule, have to make large advances to the men and take the risk of being reimbursed for their outlay at the end of the voyage. If the vessel is successful, they are paid; otherwise, not; for the men are generally irresponsible and have little consideration for liabilities contracted in this manner. There is, as a matter of course, unstinted grumbling, but after Jack has had his growl, which invariably comes after settling and "signing clear," he looks for a ship and enlists for another cruise upon the first "blubber-hunter" he can find that needs a crew.

The following, from the San Francisco Examiner (November 12, 1888), expresses Jack's view of it, and shows why many old hands continue in the business from year to year:

> "It's tough [said an old salt in explanation], but it's the usual run. I've been at it 8 years now, and I've grown to expect it."
>
> "Why don't you drop the business then?"
>
> "Blamed if I know. You see us fellows usually sail the same old familiar course, no matter where it leads to. We growl, of course, and do some swearing, but we're usually back in the ice again the next season. I suppose it's because we don't know anything else, and because it's so hard to strike a new course." * * *
>
> "You signed clear for $1.50, but how much did you owe the ship?"[*]
>
> "Fifty-seven dollars they made it. I've been 8 years at the business, and I know enough to pull all I can out of the slop-chest while we are afloat. It never makes any difference; you only get a dollar or two when you are paid off anyhow, even if you never touch a rag. If the whaling bosses don't beat you on the slop-chest they beat you on estimating the catch. Go for the slop-chest, say I, and get a dud or two anyway. * * *
>
> "Here we are after a 10-months' cruise turned ashore without a copper. We've got to live. * * * We are then in the boarding-house keeper's clutches, where the bunk bills run up. He turns us over to the whaling master and so squares our account with advanced money, and so we go the round."

The above will show that the average whaleman has a hard lot, for which he himself is largely responsible. His desire to "come square," necessarily leaves him in the power of others. One who has had experience in the business says:

> It is the sailors' own fault. The first thing they do on signing articles is to draw an advance—all they can get. In order to protect ourselves we are obliged to limit

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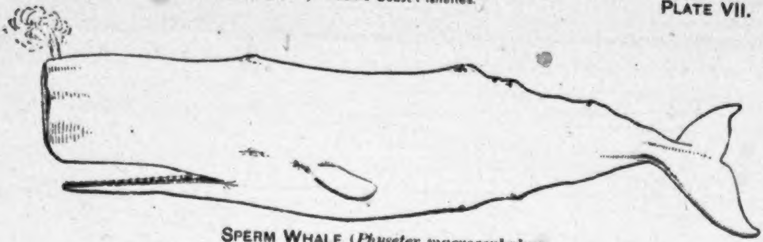
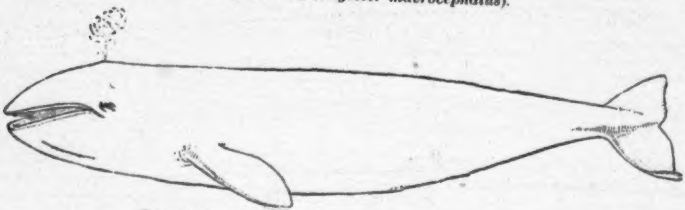
[*] Ordinarily there is nothing due to the seamen at settling, and they are paid $1 each for signing the following document, which is denominated "signing clear:"

> San Francisco, ——— —, 188-.
>
> This is to certify that I have this day been discharged from the bark ———, ———, master, by mutual consent, and in consideration of receiving my discharge at this port I hereby acknowledge the receipt of ——— dollars in full settlement and compromise of all claim or claims I have or may have against the agents, owners, and master of said bark or vessel for services rendered by me to date.
>
> (Signed)
>
> ——— ———.

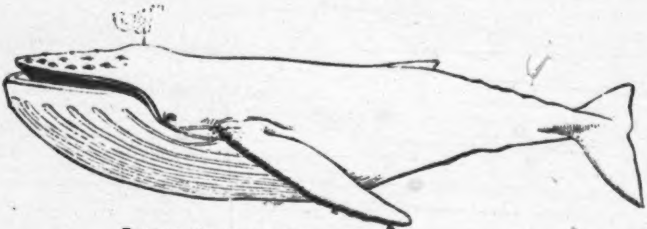
PLATE VII.



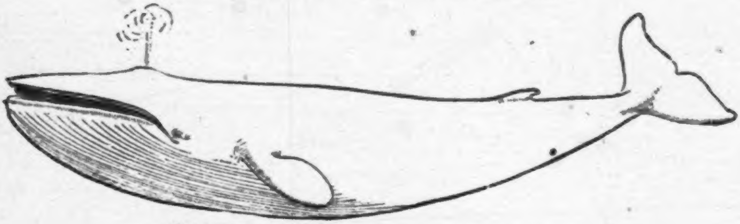
Sperm Whale (*Physeter macrocephalus*).



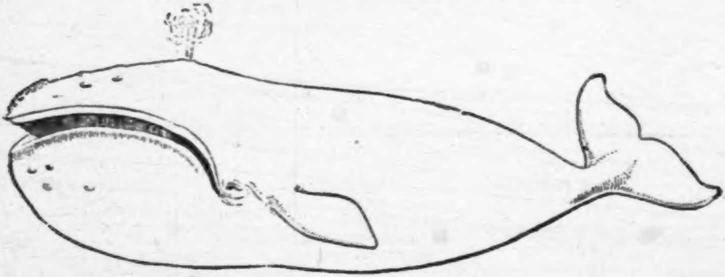
California Gray Whale (*Rhachianectes glaucus*).



Pacific Humpback Whale (*Megaptera versabilis*)



Sulphur-bottom Whale (*Sibbaldius sulfureus*).



Pacific Right Whale (*Balæna japonica*).)

the advance of a foremast hand to $60. I admit that the boarding-house keepers and the shippers get the most of it, but that is not our fault. Then, the hands usually come aboard with no outfit, and during the cruise they draw heavily on the slop-chest. They're a sharp lot, and if the catch is small they've usually drawn enough out to be ahead of the company at the end of the voyage.

Those who are temperate, brave, ambitious, and quick to learn the technicalities of the trade rapidly attain promotion, particularly if successful, as subordinate officers, in killing whales. Such men ultimately rise to responsible positions, as mates or masters, and nowhere can there be found those who excel them in hardihood, determined bravery, seamanship, and resource in the many trying emergencies incident to their calling. Nowhere do men meet with greater peril or more trying exigencies, and the training they get in this adventurous calling develops the highest qualities of seamanship and fits men not only to take a prominent part in this fishery, but to rise to distinction in other branches of maritime enterprise.

Species, seasons, etc.—The species chiefly sought by the San Francisco whalemen are the bowhead (*Balæna mysticetus*), the California gray (*Rhachianectes glaucus*), the right whale (*Balæna japonica*), and the sperm whale (*Physeter macrocephalus*). Occasionally a humpback may be captured, and sometimes considerable numbers of walrus are killed for their skins and ivory.

The fishing season of the Arctic fleet is usually from about the first of May to the first of October, though the vessels have sometimes stayed later, occasionally at fearful sacrifice. In some cases vessels have been caught in the ice and had to be abandoned. The fleet usually reaches the Gulf of Anadir or vicinity about the first to the middle of May. The vessels cruise south of Bering Strait until the ice breaks up sufficiently for them to force their way through the strait into the Arctic Ocean. This is generally about the first to the middle of June. The whales enter the Arctic about the first of the month, and no effort is spared to come up with them.* The vessels work along the Asiatic coast in the early part of the season, because the "leads" are usually most favorable there, but they push across to Point Barrow as soon as the ice opens enough to permit them to go eastward.

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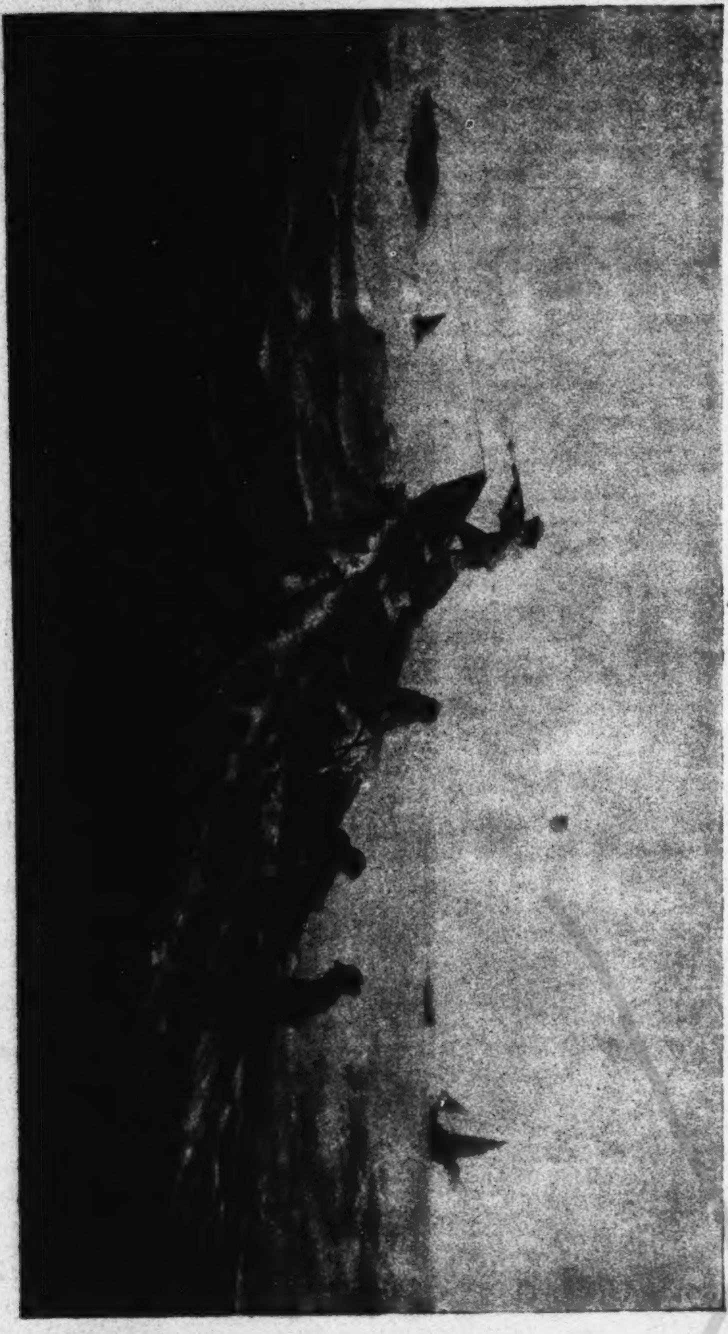
* When the whales enter the Arctic they follow up the American shore into the northeast as fast as the ice breaks up. They go, nobody knows where, but it is surmised into the great basin at the mouth of the Mackenzie River. But the eastward of Point Barrow is a dangerous region; there may not be a cake of ice in sight, yet a sudden change in the wind may bring up the pack in a twinkling. No places of retreat are at hand, for the water is shallow inshore, hence ships, if caught, would most likely be pushed high and dry on the beach. Ships of much draft drag their keels in the mud if they go so far to the eastward. One of the greatest dangers in Arctic whaling is this going east of Point Barrow. Yet the steamers and many sailing vessels venture there at every opportunity. Franklin's Return Reef is the farthest limit, though in 1886 steamers reached Barter Island and aimed at Herschel's Island, 450 miles from Point Barrow. Had they gone there, however, they would have been shut in for the winter. (From advance sheets of "Arctic Alaska and Siberia," by Herbert L. Aldrich.) Published in *Outing* for November, 1889.

From the time of entering the Arctic until Point Barrow is reached, generally about August 1, the chief occupation (it is considered a pastime) is hunting walrus, immense herds of which are sometimes met with on the ice floes, particularly near Cape Serdze-Kamen. This period of six or seven weeks is called "between seasons" or the "summer season," and unless walrus are found it is generally devoid of profit or excitement. Occasionally whales are met with and in some seasons many have been taken in the western Arctic.

The Arctic season, properly speaking, is from the middle of August to the first of October, for during this time nearly all whales are captured. What with the frequent hairbreadth escapes of ships and men from dangers that beset them in ice, fogs, etc., and the adventures met with in killing whales, this is a period filled with excitement.

Aldrich gives the following graphic account of his recent experience on a whale ship while on a passage from San Francisco to the Arctic ocean:

> "*Blow!*" "*blow!*" came down from the crow's nest late one afternoon after we had for days tacked this way and that on the lookout for whales, and incidentally also for "leads" through the ice pack, for we were in Bering Sea. It had been a long passage from San Francisco; not a sail had we seen for 52 days. No wonder, then, that we rejoiced when suddenly five sails hove in sight. But this spasm was overshadowed by a new excitement. It was a whale—the first whale! Every man was electrified. The boats were made ready to "lower away," but the whale was in too much haste to wait to be caught, and disappeared in the ice.
>
> * * * * * * *
>
> On the evening of the 28th of May a sail was sighted at the south and in the morning there were six more. We recognized them as part of the fleet that had gone eastward in hopes of getting north along the Alaskan coast. They had found the solid ice-pack as far south as St. Paul's Island, so returned. With them came news from ships at the south, the two chief items being that twenty-one whales had been caught and that the *Stamboul* had been stove, not so seriously, however, but that she could be repaired.
>
> This was the slowest getting anywhere I had ever experienced. On the 1st day of May we were 100 miles below Cape Navarin. A week later we were off the Cape. Then we pressed forward and went perhaps 50 miles, but only to be beset in the pack and remain 3 days without moving a ship's length, except as the current carried us. Then a northwesterly gale carried us back below Cape Thaddeus. Four or 5 days later the ice opened sufficiently to allow of making an attempt to work northward, and in 2 weeks we had only gone about 100 miles. During these 2 weeks we had sailed north and drifted south, sailed south and drifted north; in fact, gone in every direction. One current carried us to within 60 miles of Anadir River, while another carried us off to the eastward. Finally the current settled down to a general northerly flow and carried us in a northerly direction at the rate of from 2 to 12 miles a day. Local currents occasionally interfered. Thus the 1st day of June each ship lay tied up to a big cake of ice, and of the vessels nearest us, the *Hidalgo*, which was east-southeast in the morning, was carried to south by east by night. The *Abram Barker* was carried from north by east to northeast by north, and the *Northern Light* from west half north to southwest by west.
>
> To be bothered like this is an everyday experience to an Arctic whaleman, and it



SHOOTING A BOMB LANCE INTO A WHALE.

is a small part of what he must submit to. A contrary current may hold him in the pack while ships about him make sail and head for the whaling grounds. Or while he is wearing and tacking about, waiting an opportunity to continue his course, he is harassed by the feeling that perhaps other ships have got through the ice somewhere else and found whales. Possibly he may be within easy sailing of a passage through the ice—as it was afterward learned we seventeen ships were—but not know it. He is always in danger of having his ship stove, and must be prepared at any moment, day or night, to fight clear of ice or flee from a threatened pack or approaching floe. These conditions come nearer the proper ones for spoiling a good temperament than any human being ought to be tempted with. Even the patient Job of old would have been sorely tried had he been an Arctic whaleman. To hang week after week on the verge of getting somewhere is far more trying to the patience than one could imagine who has not experienced it.

An experience of Captain Cogan, of the *Hunter*, in 1886, is typical of what exertion a whaleman will make to prosecute and complete his voyage. In going through the Gulf of Anadir he broke a piece out of the *Hunter's* outwater, but did not deem it necessary to stop and repair it. When off St. Lawrence Island he was caught in a whirlpool, had the rudderhead nearly twisted off, and two of the pintles holding the rudder broken. It was necessary to make this damage good, when he started on again. When off Icy Cape he struck bottom ice, knocking in six timbers 6 feet from the keel forward of the fore chains. This caused a serious leak, but by running all pumps and bailing he got at the break and stopped two-thirds of the flow. Turning about he went into Kotzebue Sound, behind Chamisso Island. The wind has a rake of 10 or 12 miles there, yet it was the last retreat at hand. Nearly everything in the ship was landed on shore. The spars were then unshipped and made into a raft, which was firmly anchored at both ends with the two anchors and then weighted down and steadied with casks of water. A strong southeasterly gale came up, making it necessary to undo all this work. But when all was again quiet the raft was rebuilt, and with this as a wharf the ship was hove down so that the keel could be reached, and the leak thoroughly repaired. Before things were stowed down again, another southeaster came on, but it was too late to do any damage. Up to the time of this mishap the *Hunter* had not caught a whale, but less than three months afterward she went into port with eleven whales. ("Arctic Alaska and Siberia," by Herbert L. Aldrich.)

The season in the Okhotsk usually begins about the last of May to the first of July, and continues to the latter part of October. The whalers enter the sea as soon as the ice permits; occasionally they have continued there until near the close of November, though in imminent danger from the new ice. Vessels have on rare occasions "wintered in the ice, in order to take advantage of the late and early seasons." The whaling season on the "Japan ground" is commonly from May to November, or essentially the same as in more northern regions. In late years, however, the whale fishery from San Francisco has been prosecuted chiefly in the Arctic Ocean and the Okhotsk Sea.

It is common for vessels to "fit away" and sail on voyages in the late autumn or early winter. The chief object is to have their crews on board and well trained before the Arctic season begins. They cruise in the Pacific and occasionally make profitable captures, though, as a rule, few whales are taken in winter. "Leaving port the whaler cruises for a while in the tropics under easy sail hunting for sperm whales, winding up for a holiday at the Sandwich Islands, or some other island port, before the ship's head is turned northward."

Boats and apparatus of capture.—A full description of the boats and apparatus would occupy more space than is available; therefore for detailed information reference is made to the admirable treatise by James Templeman Brown on "The Whalemen, Vessels, and Boats, Apparatus, and Methods of the Whale Fishery" (vol. II, section V, "Fisheries and Fishery Industries of the United States," pp. 218–318.)

The typical whaleboat propelled by oars and sails is still in favor and universally employed. That it has held its own in this age of innovation and invention is sufficient evidence of its excellent qualities and the high degree of specialization which it attained many years ago.

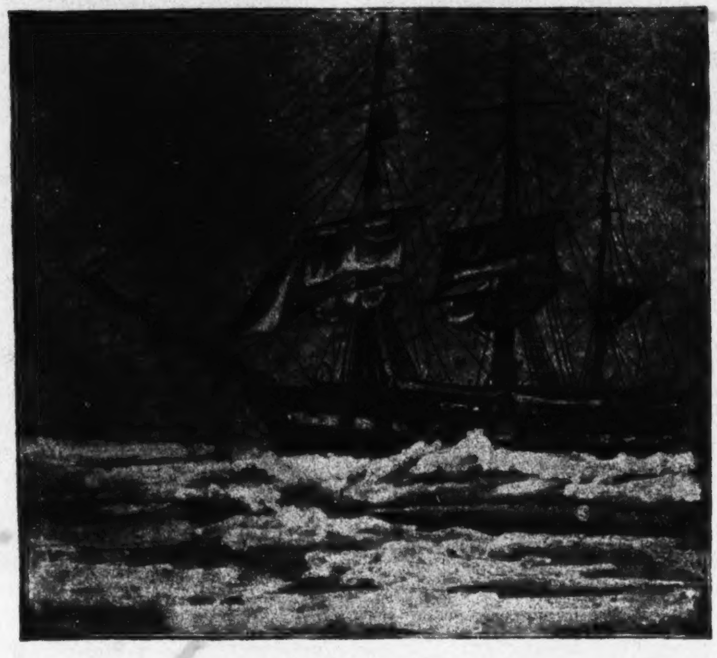
In 1882, according to Brown, a very noticeable innovation was suggested by Lieut. Commander Z. L. Tanner, U. S. Navy, who is now in command of the U. S. Fish Commission steamer *Albatross*.

During the "season" in the Arctic calms or light winds are often prevalent, and at such times it is difficult and generally impossible for sailing ships to reach the vicinity of whales seen many miles distant. Without steam launches the only available course is to row the boats to the point where the whales are seen, which is frequently a distance of 8 or 10 miles from the ship. The desire to reach them in advance of others, or before they disappear in the ice, prompts the crews to put forth every possible effort, the consequence usually being that the men are exhausted with pulling before they come up with the whales, and thus are often more or less unfitted for the arduous and dangerous duty of effecting captures, and the still more laborious task of towing dead whales to the ship.

The thought occurred to Captain Tanner that under such circumstances a steam whaleboat could be most effectively used to tow the other boats rapidly to the scene of action, so that the men could begin their work in a fresh and vigorous condition, with much greater assurances of success. In like manner the whales and boats could be towed to the ship by the launch, or, if more convenient, the ship could be brought to the whales. The idea was a good one, and but for the peculiar conditions under which the fishery is prosecuted complete success would doubtless have been attained.

The firm of I. H. Bartlett & Sons, of New Bedford, made the first experiment with steam launches (building one in 1882), and others soon tried them. These boats were built in New Bedford at an average cost of $1,250. They had oak frames and cedar plank; were sharp aft like a whaleboat, and were fitted with coil boilers of the Herreshoff pattern; the screw propeller was amidships, and so arranged that it would fold into the keel whenever it was necessary to go upon a beach or ice. The dimensions were as follows: Length, from 30 to 32 feet; beam, 7½ to 8 feet; depth, 4 feet. The first one built was 28 feet long and 7 feet wide.

So far as can be learned the use of these launches has been to some extent discontinued. It was soon found in practice that the service



WHALER IN THE ICE.
(From Aldrich's "Arctic Alaska and Siberia.")

TRYING OUT.
(From Aldrich's "Arctic Alaska and Siberia.")

actually performed was small compared with the extra expense for cost of building and hire of engineers to run them, added to which was the time consumed in making necessary repairs to engines, etc. While in good condition they were often of great service in towing boats and whales in moderate weather, but frequently they were out of repair when most needed. Mr. Aldrich, however, mentions the steam-launch upon the ship he sailed on in 1887, and frequently refers to its employment in killing whales.

The toggle harpoon, the hand lance, the whale gun, and the explosive bomb lance are the apparatus chiefly relied upon for killing whales. These have been so fully and so frequently described by others that it is only necessary to briefly mention them here.

The necessities in the Arctic whale fishery have led to the invention of bomb guns. The tendency of whales in northern regions is to dive under the ice after being struck, and this is little to be wondered at when ice floes are usually near on all sides. With the old methods of whaling with harpoons and hand lances it was difficult and often impossible to kill whales quick enough to prevent their escape. This resulted in the introduction of guns and the shooting of explosive bomb lances into whales, which are now usually killed in a very short time by a well-directed shot. Two kinds of guns are used. One of these, the "Pierce gun," is commonly called a "darting gun." "Were it not for this kind of gun," says Brown, "ice-whaling could not be successfully pursued." This consists of a stockless gun barrel, which holds the powder and bomb, attached to the harpoon in such a manner that when the iron enters a whale the gun is discharged, driving the bomb deep into the animal.

A shoulder gun is also in favor, and is generally used in conjunction with the hand-thrown toggle harpoon. After a whale has been "fastened to," at the first opportunity a bomb lance is shot into him, and this is continued on every favorable occasion until he succumbs.

Methods of capture, preparation of products, etc.—The greatest care is exercised in approaching whales, for these animals have grown shy from being hunted so much, and the least noise will make it impossible to get near them. Whenever there is wind the boats get to windward and then sail down upon a whale, and the utmost silence is preserved until the harpoon is thrown, when the sheets fly off and "Starn all!" is the order to the men waiting with oars ready to drop them into the water and drive the boat astern beyond the reach of the whale's flukes, that otherwise may sweep round with terrible force and smash a boat into splinters.

The following, from the pen of one who has recently (1887) participated in the Arctic whale fishery and personally witnessed its methods, may be appropriately quoted here:

> The day was beautiful, and the captain and I embraced the opportunity to make the round of the nine ships at anchor. When on the extreme northern ship a whale

was "raised" or seen coming leisurely along the edge of the shore ice. The news spread like wildfire, and in a few minutes thirty or more whaleboats were flitting about, each endeavoring to get as near as possible to the spot where the whale would next rise to spout.

When he rose a boat darted an iron, but it did not hold. At the next rising another boat attempted to hit, and also failed; but the third boat made fast to him. It was a grand sight to see the whale make a lunge and start seaward, towing the boat after him at a terrific pace. He went a mile or two, then wheeled about and made a straight line for the shore ice. Another boat was soon alongside to bend on more line to the nearly exhausted tubs of the first boat.

All the captains became so excited and interested in the chase that they longed for some of the fun; so four of them took the *Hunter's* steam launch, I accompanying them. As soon as we reached the shore ice I saw the whale spout behind a long point of ice. It would have taken a boat a considerable time to sail there, but we steamed around it and, before I could comprehend the situation, were alongside the monster. It seemed incredible that such a powerful creature could be killed. With Captain Cogan at the helm, Captain Sherman with a darting gun, Captain Kelly with a shoulder gun, and Captain Winslow and myself as ballast, we bore down on him, fired two bombs into him, and rushed past just in time to escape a sweeping blow from his powerful tail.

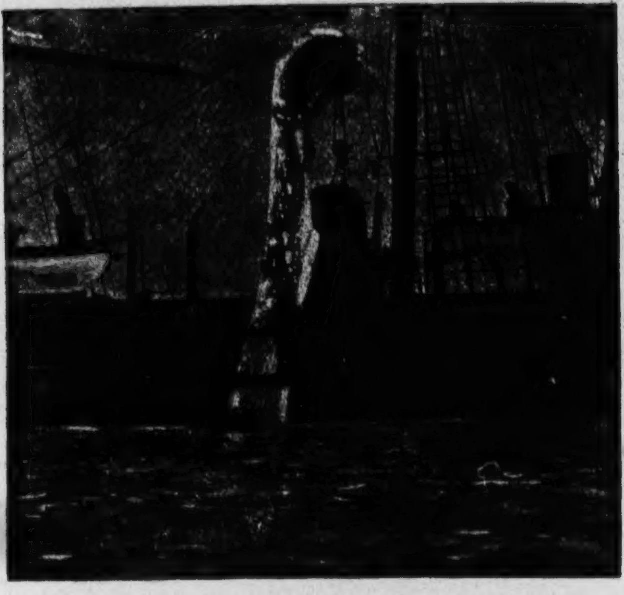
It is disappointing to see a whale, for most pictures represent him as standing up like a buoy or posing with his tail on top of the water. The real fact is that only the top of the head about the spout hole and a small piece of the back are seen, and perhaps the "flukes" or, in common English, the tail may take an occasional sweep in the air. When as near as we were, so that we could look down into the water upon the creature, his great size could be partially comprehended.

It seems to be the duty of every man in the boat when the whale is struck to yell at the top of his voice. Even where there is dignity to be kept up, a certain amount of this has to be done. In the midst of the shouting was heard the muffled "boom," "boom" of the two bombs, and the whale rolled over dead without a struggle. I staid aboard the *Lucretia* that night to see the whale cut in.

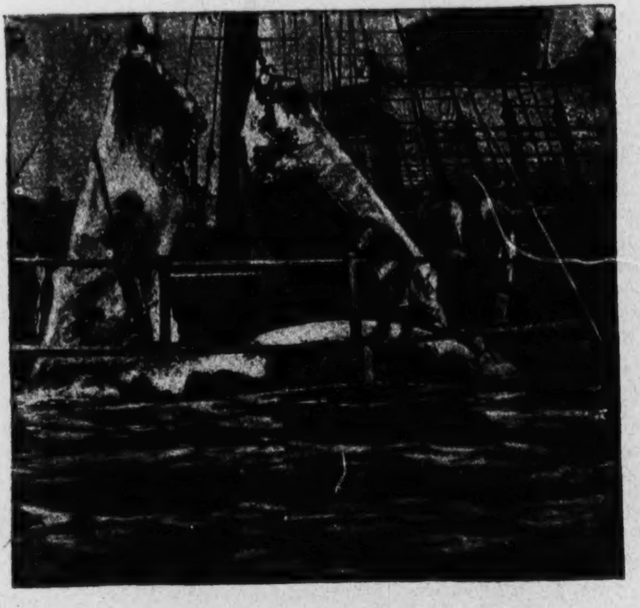
As soon as a whale is killed the vessel gets under way and sails to him, taking him on the starboard side in front of the gangway. With a steamer, as in this instance, this is very easily done, but a sailing vessel may find it necessary to maneuver some time before getting the conditions right for work. First, a strong chain or hawser is secured around the flukes. This runs through the hawse pipe and is firmly fastened to the forward bitt near the windlass. Then another chain is secured to one fin, and it is with this second chain that the whale is managed.

The carcass runs fore and aft, the head being aft, and the fin in front of the gangway. With sharp cutting spades a man cuts through the blubber, circling around the whale from the extremity of the mouth toward the tail, corkscrew like. He cuts down to the "lean." By hauling on the fin chain the carcass rolls, and the "blanket piece" of blubber tears itself off, aided by the cutting spades. When the whale is rolled quarter over one lip comes uppermost. A tackle is fastened to this, then it is cut off, hoisted on deck, and dropped into the "blubber room," as the space between decks from the mainmast to the forecastle is called. All hoisting is done by the windlass, and in most of the vessels power comes from a donkey engine. The blanket piece is started again and the whale rolled half way over. The throat is then uppermost. This in turn is cut off and deposited in the blubber room, then the other lips rolled up and removed. By this time the blanket piece becomes unwieldy in its length, so another hold is secured close down to the carcass [by hooking on another tackle], and the strip of blubber, perhaps 15 feet long and 6 feet wide, cut off and dropped into the blubber room.

The most difficult part of the whole operation is now at hand, and that is to cut off the "head" or upper jaw, which contains all the whalebone. A false or careless move



TAKING IN A BLANKET PIECE.
(From Aldrich's "Arctic Alaska and Siberia.")



CUTTING IN A LIP.
(From Aldrich's "Arctic Alaska and Siberia.")

might destroy hundreds of dollars' worth of bone, or, possibly, cause the loss of the whole head. A chain is carefully drawn through a hole cut between the scalp bone and the tough blubber about the spout hole. The backbone is chopped nearly through near where the blanket piece was started, then by a jerk of the tackle the weight breaks the remainder and the head is hauled on deck. There was once a whaling captain who disjointed the head instead of chopping it off. My whale's head contained about 2,500 pounds of whalebone, and as the price of bone was $3.50 a pound at that time, it can readily be seen how anxious a whaleman must be when cutting in until he gets the head on deck. Heads contain over six hundred slabs of bone, and in a large whale like this the pieces range in length from 12 feet, or a little over, down to a few inches. For convenience in working each ship has a "cutting stage" of planks that hangs over the water in front of the gangway so that the men can stand nearly over the whale. It is from this that the work is done, and it was here that I stood to see the whole operation.

With the head cut off, the rest of the cutting in is easy and simple. The blanket piece is peeled off in strips about 15 feet long, until a point near the flukes is reached. There the backbone is disjointed. The final haul brings on deck the flukes with the blanket piece. The carcass either floats off or sinks. These blanket pieces of blubber are cut and torn off the whale in the same manner that the peel is cut and torn off an orange when paring it. Frequently the natives are aboard, and work is done slowly in order that they may have an opportunity to cut off as much as possible of the lean meat. The cutting in was a novelty to me, but the work of the natives was more entertaining. They had six canoes crowded in near the whale, and the instant there was a lull in the proceedings, a man from each would clamber onto the carcass, splash about in the blood and water, and slash away at the meat with villainous-looking knives. They worked like heroes and yelled like fiends. Some worked with their hands under water, and most of them were knee-deep in it all the time. One fellow lay almost flat on his stomach and burrowed in under the blubber in advance of the cutters. His feet were flying about dangerously near keen-edged knives, but he did not get cut.

Whalemen still observe the old sperm-whaling custom of lustily shouting "Hurrah for five and forty more!" when the head or last piece of blubber is landed on deck. But this shout is not because the work is all done. Early the next morning the try-pots were set to working. First, the blubber was cut into "horse pieces" about a foot square and 2 feet long, then "minced," that is, cut into thin slices to facilitate the trying out of the oil. The blubber then goes in the pots, and after the oil is boiled the remains of the blubber have become hard and brittle, but are pressed to get the last dregs of oil; then these "scraps" are used for fuel, and they make a hot fire. This night the sun barely dipped below the horizon at midnight, but when darkness does interfere with a trying-out, a lot of scraps are put into a wire basket and lighted, making a "bug light," which is equal to a pitch-pine torch. The oil is slowly baled from the try-pots into a cooler, and after running through two or three is pumped into casks and stowed down into the hold. This whale made 120 barrels of oil. ("Arctic Alaska and Siberia," by Herbert L. Aldrich.)

While the method of trying-out described above is the orthodox one, and the old-timed "try-pot" and scrap fires are still in most common use, an improved plan of trying out the blubber by means of steam digesters has been adopted on some of the steam whalers.

When boiling the men usually have watch and watch, each watch working 6 hours and resting 6 hours. Ordinarily the Arctic whalemen arrange so that one watch has 8 hours on deck one night and 4 hours during the next day, while the other watch gets the 8 hours "below" at night. The change or alteration of watches that occurs every night by the introduction of the "dog-watches" makes the matter even, so that each watch has the 8 hours off duty each alternate night. But when whales are raised no regard is had for the "watch below," and all hands tumble out and are on the alert when the cry of "There she blows!" resounds through the ship. While the trying-out proceeds, the boat-steerers improve all chances they get to put their boats in order and to arrange harpoons, lines, etc., for another capture.

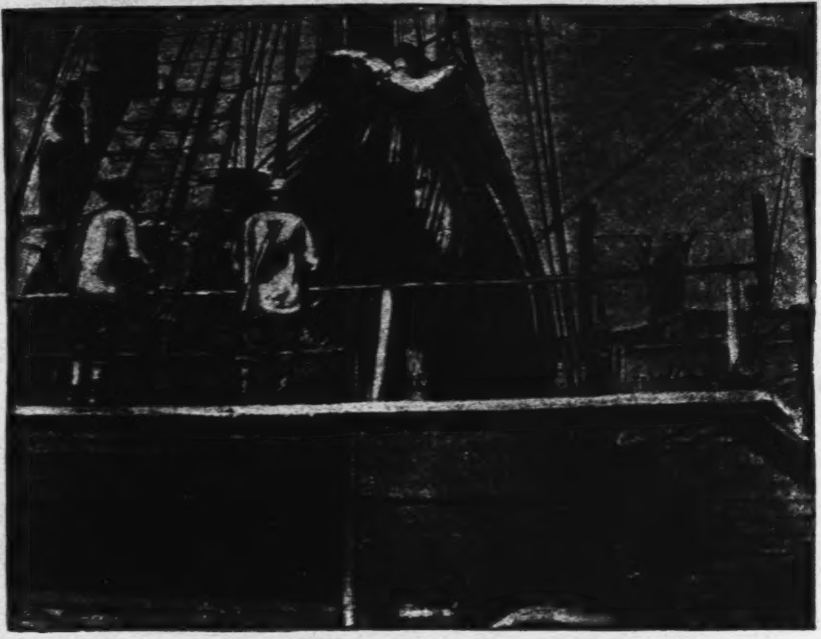
The bone is by far the most valuable portion of a baleen whale and receives special attention. Some of the small schooners hunt for bone only, and make no attempt to save the blubber of whales captured by them, but give this away to larger craft, if any chance to be near. Such vessels are called "bone-hunters." When the head of a bowhead or right whale has been hoisted on deck, the whalebone is taken from it by cutting into the gums, to which the baleen is attached. As a rule the gums are taken out in sections, each of which has ten slabs of bone; these are thrown into the hold, and later the bone is scraped, washed, and packed away in a condition ready for market.

A correspondent of the New York *Herald* of November 6, 1887, writing from Bering Strait, under date of October 7, makes the following remarks concerning a noticeable feature in whalebone taken that year:

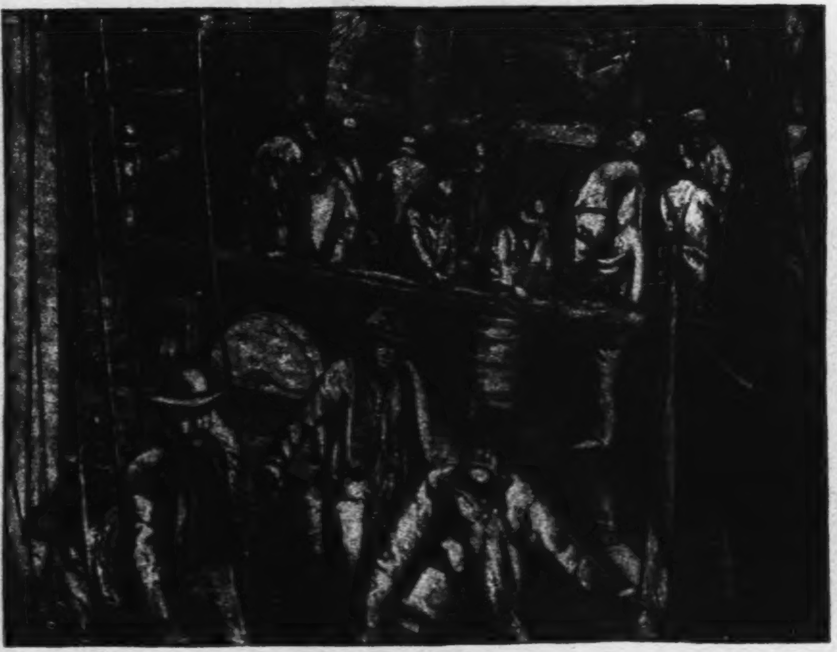
> Another feature of the whaling this season has been the amount of white whalebone taken, and in nearly every instance, if not all, it has been found in the bulls of 70 to 100 barrels. Whether it is a peculiarity of the sex could not be learned. Many whalemen have believed it to be a freak of nature, but with as many cases as have occurred this year there must be some specific cause for it.

Despite the hard work of cutting in, trying-out, and cleaning bone, the slipping about on greasy decks, and the unsavory odors from the try works, these occasions are generally the gala days of the whaleman's life, for he has a "share" in every gallon of oil and every pound of bone that goes into the hold. But when the sun has turned on her southward course, the short Arctic summer is passed, and gales of autumn come with icy chilliness, quickly freezing every drop of spray that flies, when "young ice" is forming and the ship is perhaps scudding away to escape the danger of being caught helpless in its grasp, then trying-out becomes a serious and uncomfortable duty that it would be difficult to keep men engaged upon were it not for the personal interest each has in the proceeds.

Tenders.—The employment of steam-whalers, the ordinary requirements of the trade, and the dangers which beset the whalemen in the fall, when the vessels are liable to be nipped and crushed in the ice, have made it expedient to employ "tenders" to carry supplies to the Arctic fleet and to bring home such part of the catch as it is most convenient to send by freight. This usually consists of bone, which is the most valuable and the least bulky part of the products. Rendezvouses have been established at Point Hope, in about 68° north latitude; at Point Clarence, in about 65° north; and at Point Barrow, in latitude 70° 20′.



HOISTING IN A HEAD OF WHALEBONE.
(From Aldrich's "Arctic Alaska and Siberia.")



CLEANING WHALEBONE.
(From Aldrich's "Arctic Alaska and Siberia.")

The tenders generally reach the fleet early in July and bring home the first fruits of the fishery late in August. They also bring the first news from the fleet, which is awaited with much anxiety, as indicating what the season's catch may be.

The tenders are usually large vessels. In 1888 the steamer *Jeanie* (862.95 tons) and the sailing bark *Thomas Pope* (226.86 tons) were tenders to the Arctic fleet.

In the tables which follow, giving the names, tonnage, catch, etc., of the San Francisco whaling fleet, and also the New Bedford vessels that rendezvous at that port, it will perhaps be noticed that some of the ships brought in oil and no bone, while others reported only bone. This is in part due to the fact that a portion of the catch had been shipped home in the tenders, though some of the vessels, particularly the schooners, do not save anything except the bone. Sometimes sperm oil taken on the winter's cruise in the Pacific, before entering the Arctic, constitutes a part of their cargoes.

In good seasons the tenders often bring home very valuable cargoes, but at other times they have little return freight. In 1888 the steam tender *Jeanie* brought home 2,800 pounds of bone and 75 barrels of sperm oil from the *Hunter*. The *Thomas Pope* returned with the following quantities of bone from the vessels named: *Abram Barker*, 2,300 pounds; *Helen Mar*, 300 pounds; *J. A. Howland*, 4,400 pounds; *Mary and Susan*, 700 pounds; *Ocean*, 4,100 pounds; *Reindeer*, 3,600 pounds; *Rosario*, 5,600 pounds; *Young Phœnix*, 2,300 pounds.

Trade.—It occasionally happens that the whalers obtain furs by bartering with the natives. The Eskimo are said to be very fond of trading. They often visit the whalers in their kaiaks, and bring anything they may have for sale. Fox skins are the principal furs obtained in this manner by whalemen, and the quantity is seldom large. About 50 to 60 pelts are occasionally secured. In 1888 the bark *Wanderer* brought home 40 fox skins and the pelages of 48 lynxes, 2 bears, and 10 otters.

Dangers.—No class of men are exposed to greater or more diversified peril than the Arctic whalemen. Comparatively recent years have witnessed most appalling disasters to the Arctic fleet. Many vessels have been nipped; some have been deserted by their crews that succeeded in reaching safety on other ships, but in far too many instances the men had no escape and finally succumbed to starvation or the rigors of an Arctic winter. Shipwrecks, "stove boats," etc., with all their attendant horrors, are commonplace events in the whaleman's life, and pages might be filled with the most startling recitals of disaster and suffering.

Financial results, catch, etc.—The catch, upon which depends the financial results of the whale fishery, varies exceedingly from year to year, the fluctuations being due to many causes, but chiefly dependent upon the movements of ice and whales in the Arctic. A successful season may be followed by one that is specially unfavorable, and *vice* versa. Nothing is more uncertain, and it is impossible at the beginning of a season for the most experienced to tell how it will turn out. There is also the utmost diversity in the fortunes of individual vessels. One ship may return "clean," without a gallon of oil or pound of bone, while another will arrive heavily laden with a cargo worth tens of thousands of dollars.

The season of 1885 was one of the most successful of recent years. Many vessels did well, and some made very large stocks. The season of 1887 was also remarkable for a big catch and some extraordinary voyages, notwithstanding the early reports were unfavorable. On November 15 the San Francisco *Examiner* made the following statement:

> An official report of the whaling vessels for the season shows that a total of 300 whales have been taken. The catch of the 39 now in port shows a result of 32,334 barrels of oil, 544,352 pounds of bone, and 550 pounds of ivory. The *Ocean* brought 400 barrels of oil and about 11,000 pounds of bone. This will bring the value of the total catch to nearly $2,000,000.*

Among the fortunate vessels was the steam-whaler *Orca*, which arrived at San Francisco October 25, 1887. It had the bone and oil of 28 whales, and might have caught others if there had been any more room on board. As each whale is worth $5,000, it will be seen that the *Orca* made a gross return to its owners of $140,000 this season. The next best catch to that of the *Orca* was made in 1880 by the *Mary and Helen*, of New Bedford, which caught 27 whales. The steam-whaler *Thrasher* was reported to have taken 25 whales by October 23, 1887.

In 1888 the whale fleet consisted of 58 vessels, including tenders, of which 5 vessels cruised in the Japan and Okhotsk Seas, 3 in the South Pacific Ocean, and 50 in Bering Sea and the Arctic Ocean (of which 11 were steam-whalers), the catch being 16,371 barrels of oil and 325,050 pounds of whalebone. The number of whales taken by the entire fleet reached 202, against 360 the previous year.

The catch for the season of 1889 was very light compared with previous years, and several vessels came home "clean," while others had only a small amount aboard. The details are shown in the tables. It is sufficient to say here that the fleet numbered 28 vessels from San Francisco and 23 from New Bedford, a total of 51, carrying 1,765 officers and seamen; 40 of these cruised in Bering Sea and the Arctic Ocean, while the others fished exclusively in the Okhotsk Sea and on the Japan ground. Only 71 whales were taken by the Arctic fleet, while 76 were captured on the Okhotsk and Japan grounds.

From the foregoing it will be seen that the financial results of the San Francisco whale fishery are important factors in the business of the city and make this industry one of the most important maritime enterprises of the port.

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* This includes, of course (as for 1885), the catch of the New Bedford fleet, which, together with the San Francisco fleet, made the 39 vessels alluded to.

The details of the whale fishery in 1888 and 1889 are given in the following tables, in which the San Francisco and New Bedford fleets are shown separately:

The San Francisco whale fleet in 1888.

Name of vessel.	Rig.	Net tonnage.	No. of crew.	Whaling grounds.	Products landed.			
					Gallons of sperm oil.	Gallons of whale oil.	Pounds of bone.	Value.
Balaena	Str	380.67	45	Bering Sea and Arctic Ocean.		32,000	12,000	$77,300.00
Beluga a	Str	409.40	45	do		29,350	13,000	63,922.00
Grampus	Str	250.26	42	do		7,300	5,000	17,341.00
Jeanie	Str	262.95	17	do				
Jesse H. Freeman	Str	350.90	45	do		5,500	4,218	14,664.30
Narwhal	Str	380.67	46	do		21,020	10,000	37,965.00
Orca	Str	402.30	44	do		50,550	35,000	128,962.50
Thrasher c	Str	343.01	42	do		11,175	8,000	27,911.25
Bounding Billow	Bark	227.93	32	do		6,300	3,500	12,705.00
Coral a	Bark	343.43	37	Okhotsk and Japan Seas.	3,721	15,750	6,000	25,550.00
Emma F. Herriman	Bark	295.10	37	do		11,025	3,500	14,206.75
Eliza	Bark	261.71	36	Bering Sea and Arctic Ocean.	440	12,000	14,000	40,006.95
Francis Palmer	Bark	200.16	35	do				
Helen Mar	Bark	393.13	34	do			300	900.00
Hunter	Bark	357.38	42	do	2,382	13,750	14,000	31,221.90
John and Winthrop	Bark	321.30	16	do	1,102	6,772		2,979.90
John P. West	Bark	236.04	38	do		7,875	6,000	17,736.25
Northern Light	Bark	395.42	40	do		5,512	3,000	12,429.30
Sea Breeze	Bark	307.24	30	do		14,902	13,000	44,236.70
Stamboul	Bark	347.42	37	Okhotsk and Japan Seas.	450	7,056	4,000	14,717.10
Thomas Pope b	Bark	315.67	11	Bering Sea and Arctic Ocean.				
Wanderer d	Bark	300.13	40	do			50	150.00
Alton e	Sch	94.30	21	do		1,300	2,000	6,441.00
James A. Hamilton	Sch	73.91	30	do				
Jane Gray f	Sch	107.07	20	do				
Rosario g	Sch	141.25	33	do			12,787	26,301.00
Ino h	Sch	92.94	22	do			6,100	15,300.00
Hidalgo i	Brig	165.07	20	do		1,670	4,000	12,464.50
Total		8,378.46	962		8,004	290,525	194,780	661,073.05

The New Bedford whale fleet rendezvousing at San Francisco in 1888.

Belvedere	Str	439.37	45	Bering Sea and Arctic Ocean.		10,900	7,500	$22,115.00
Lucretia	Str	275.61	45	do		4,725	3,000	10,658.75
William Lewis	Str	332.04	41	do				
Abraham Barker	Bark	381.00	40	do		3,150		1,102.50
Andrew Hicks	Bark	307.06	37	do	1,000	17,325	14,300	50,990.25
Alaska	Bark	323.00	29	do				
Bertha	Bark	165.51	37	do				
Charles W. Morgan	Bark	296.06	25	do	4,322	12,265	4,000	20,133.85
Cape Horn Pigeon	Bark	201.42	31	Okhotsk and Japan Seas.		27,503	9,700	28,746.70
Fleetwing	Bark	211.15	35	Bering Sea and Arctic Ocean.				
Josephine	Bark	365.32	37	Okhotsk and Japan Seas.		30,675	9,000	36,628.25
James Allen	Bark	330.96	20	South Pacific Ocean.	94			41.70

a 50 fox skins in cargo.
b Tender to the fleet.
c 280 pounds of walrus ivory landed.
d 40 fox skins, 48 lynx skins, 2 bear skins, and 10 otter skins in cargo.
e 400 pounds of walrus ivory landed.
f Abandoned at sea; vessel picked up.
g Killed 36 walrus, yielding 5,000 pounds of hides and 110 pounds of ivory.
h Vessel lost; crew saved.
i 300 pounds of walrus ivory landed.

The New Bedford whale fleet rendezvousing at San Francisco in 1889—Continued.

Name of vessel.	Rig.	Net tonnage.	No. of crew.	Whaling grounds.	Products landed.			
					Gallons of sperm oil.	Gallons of whale oil.	Pounds of bone.	Value.
Jacob A. Howland	Bark	327.41	40	Bering Sea and Arctic Ocean.		17,010	14,400	$49,153.[illegible]
Lancer	Bark	280.75	36	do		7,068	8,700	23,268.70
Lagoda	Bark	182.29	30	South Pacific Ocean.	3,300	2,420		3,762.00
Lydia	Bark	212.29	33	Bering Sea and Arctic Ocean.		15,000	5,400	21,408.00
Mars	Bark	302.41	34	do				
Ocean	Bark	274.33	34	do		14,175	10,000	24,962.25
Ohio	Bark	186.57	32	do		16,600	11,080	40,659.05
Ohio 2d	Bark	264.09	30	do				
Reindeer	Bark	280.62	31	do		7,560	5,706	19,746.00
Sea Ranger	Bark	268.45	31	do		14,175	10,580	38,461.35
Triton	Bark	251.00	37	do				
Tamerlane	Bark	153.67	23	do	1,575			698.25
William Baylies	Bark	290.33	40	do	2,365			1,212.75
Mary and Susan	Bark	311.61	40	do		21,137	12,000	40,394.45
Young Phenix	Bark	257.65	40	do			700	2,106.00
James Arnold	Ship	330.35	37	South Pacific Ocean.			2,300	6,900.00
Niger	Ship	261.11	36	Bering Sea and Arctic Ocean.				
Alexander	Brig	120.86	25	do				
Total		8,846.97	1,024		15,316	228,777	120,300	478,345.75

The San Francisco whale fleet in 1889.

Name of vessel.	Rig.	Net tonnage.	No. of crew.	Whaling grounds.	No. of whales taken.	Products landed.		
						Gallons of oil.	Pounds of bone.	Value.
Balaena	Str	398.67	45	Bering Sea and Arctic Ocean.	2	7,000	5,324	$20,[illegible]
Beluga	Str	489.40	45	do	2	7,781	4,571	18,070
Grampus	Str	250.25	42	do	2	6,198	5,125	19,462
Narwhal	Str	360.67	46	do	8	22,000	14,216	57,180
Orca	Str	462.30	44	do	4	8,230	4,244	17,040
Thrasher	Str	318.91	42	do	12	27,400	18,091	74,237
Jesse H. Freeman	Str	330.00	44	do	2	2,331	2,740	10,382
Wanderer	Bark	286.13	46	do	½	1,960	1,046	4,[illegible]
Bounding Billow	Bark	227.63	37	do				
[illegible]	Bark	201.71	35	do	1	4,065	1,000	7,057
Helen Mar	Bark	308.13	35	do	3	6,040	5,200	19,045
Northern Light	Bark	395.43	46	do	2½	9,450	7,215	26,217
Hunter	Bark	337.28	43	do	1	5,618	3,210	12,064
Sea Breeze	Bark	307.24	30	do				
James Allen	Bark	330.00	33	do	2	2,433	6,000	21,035
Thomas Pope	Bark	216.86	11	do				
Cora	Bark	345.07	37	Okhotsk and Japan Seas.	10	37,800	12,000	55,942
Stamboul	Bark	347.65	37	do	9	16,000	6,700	28,151
John P. West	Bark	335.64	35	do	11	23,025	6,000	26,414
Emma F. Herriman	Bark	308.16	37	do	8	31,500	12,000	50,405
John and Winthrop	Bark	321.39	16	do				
[illegible]	Brig	165.90	20	Bering Sea and Arctic Ocean.				
[illegible]	Sch	141.26	23	do	1	3,180	3,150	11,000
La Ninfa	Sch	110.84	23	do	1	815	2,100	7,288
Mary H. Thomas	Sch	92.00	22	do			1,600	5,100
Jane Gray	Sch	107.07	20	do	1	3,126	1,600	6,600
[illegible]	Sch	64.30	21	do			1,900	6,400
James A. Hamilton	Sch	73.91	20	do				
Total		7,600.21	988		99	235,051	138,900	540,977

* Tenders to the fleet.

† Lost in 1889.

The New Bedford whale fleet rendezvousing at San Francisco in 1889.

Name of vessel.	Rig.	Net tonnage.	No. of crew.	Whaling grounds.	No. of whales taken.	Products landed.		
						Gallons of oil.	Pounds of bone.	Value.
Belvedere	Str	[illegible].77	45	Bering Sea and Arctic Ocean.	3	2,770	3,000	$14,[illegible]
William Lewis	Str	[illegible]	41	do	3	6,615	5,[illegible]	18,150
Andrew Hicks	Bark	[illegible]	37	do	2	....	2,960	12,[illegible]
Lancer	Bark	[illegible].75	36	do	3	4,[illegible]	4,235	16,125
Lagoda	Bark	[illegible]	30	do	1	....	1,[illegible]	3,[illegible]
Mars	Bark	343.44	34	do	....	....	....	....
William Baylies	Bark	[illegible]	40	do	1	5,518	3,[illegible]	10,150
Jacob A. Howland	Bark	337.90	45	do	4	9,785	6,360	24,[illegible]
Josephine	Bark	[illegible]	37	do	1	1,[illegible]	1,[illegible]	3,[illegible]7
Reindeer	Bark	[illegible]	31	do	3	9,450	7,700	22,[illegible]
Alice Knowles	Bark	287.91	35	do	1	1,275	1,[illegible]	4,[illegible]
Abraham Barker	Bark	301.20	40	do	1	3,[illegible]	2,700	10,716
Triton	Bark	251.90	37	do	....	....	[illegible]	[illegible]
Tamerlane	Bark	[illegible].57	33	do	1	2,010	1,700	6,[illegible]
Ocean	Bark	274.32	34	do	1	2,[illegible]	2,[illegible]	7,[illegible]
Sea Ranger	Bark	[illegible].46	31	do	2	4,725	3,[illegible]	12,[illegible]
Lydia	Bark	313.30	36	Okhotsk and Japan Seas.	12½	23,940	7,300	33,[illegible]
Cape Horn Pigeon	Bark	291.42	31	do	14½	30,210	10,[illegible]	47,[illegible]
Charles W. Morgan	Bark	[illegible]	35	do	6	16,[illegible]	6,[illegible]	27,771
Alaska	Bark	332.60	30	do	8	21,[illegible]	10,[illegible]	46,[illegible]
Alexander	Brig	136.[illegible]	35	Bering Sea and Arctic Ocean.	....	....	....	....
Lucretia *a*	Str	275.61	45	do	....	....	....	....
Ohio 2d *a*	Bark	344.[illegible]	30	do	....	....	....	....
Total	....	[illegible]	828	....	67	166,274	82,435	368,[illegible]

a Lost in 1889.

THE COD FISHERY.

General considerations.—San Francisco is the only port on the Pacific coast of the United States from which this fishery has been prosecuted, and even there its importance has declined materially in recent years. The most prominent causes of decline are (1) lack of demand in domestic or foreign markets;* (2) the keen competition of Eastern producers, who send quantities of Atlantic cod to the west coast; and (3) the tendency for capital to seek investment in the more promising salmon fisheries of Alaska.

Historical review.—The history of the Pacific cod fishery is interesting, and is replete with characteristic examples of the business enterprise of the West, as well as illustrations of the professional skill and indomitable energy for which American fishermen have always been noted. The establishment of this fishery on a commercial basis is a prominent instance of what may be accomplished by seizing upon opportunities that accident has shown to exist. Previous to 1863 all of the salt-cured cod and smoked fish used on the Pacific coast were the products of the Atlantic fisheries, and were brought across the Isthmus or shipped around Cape Horn. The transportation charges were high, and the product was often injured or entirely spoiled in passing through the heat of the tropics. Dried cod was, consequently, difficult to obtain on the Pacific coast, and always expensive to the consumer, while dealers frequently suffered severe loss by being compelled to throw consignments of fish into the bay.

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*See discussion of this under head of "Markets, transportation, etc.," page 107.

In 1857 Capt. Matthew Turner, master of the brig *Timandra*, 120 tons, sailed from San Francisco with an assorted cargo for Nicolaevsk, on the Amoor River. He was detained, however, for three weeks at Castos Bay, at the head of the Gulf of Tartary, because the Amoor River was full of ice when he reached the Asiatic coast. While the vessel lay there waiting, anchored in 3 fathoms of water, the crew began fishing over the rail with hand lines, simply as a pastime. They were surprised to find plenty of cod, averaging about 2 feet in length. Captain Turner had not previously seen codfish, but some of his crew were familiar with the species, and he, knowing their market value at San Francisco, appreciated the importance of the discovery and became interested in the fishing. Two years later Captain Turner made another trip to the Amoor River. Reaching Saghalin Island, off the Gulf of Tartary, he began fishing for cod and found them very abundant. Only enough were taken for ship's use, however, for he was not provided with the means to cure more.

In 1863 Captain Turner once more sailed in the *Timandra* to Amoor River. But this time he went prepared to catch and cure some cod on his return voyage. Besides fishing gear, he carried 25 tons of salt. Returning he stopped to fish at the Gulf of Tartary. Cod were plentiful at first, and 10 tons were taken in a few days, and salted in kench. But suddenly the fish disappeared and none could be caught. Then the brig ran down the coast to southern Kamtchatka, where fish were found in abundance, and excellent success was met with on the first day. The vessel lay near the rocky coast, and on the second day, during the prevalence of a dense fog, both anchors were lost. This mishap compelled Captain Turner to abandon fishing and to leave the coast; he reluctantly sailed for home. His fish sold at San Francisco for 15 cents per pound, and his voyage would have been notably profitable if the loss of anchors had not interfered with obtaining a full fare. This was the first occasion that salt cod were landed on the west coast from Pacific fishing grounds.

In 1864 Captain Turner sailed in his brig on a cod-fishing voyage. Thus the *Timandra* was the first vessel to engage in this industry from Pacific ports. On the same grounds visited the previous year a fare of 100 tons of codfish was obtained, and the voyage was remunerative. The same year the schooner *Alert* made a trip to Bristol Bay, Alaska, in pursuit of cod. Her voyage proved a failure, for she took only 9 tons of fish.

Captain Turner states that since he made his voyages to the Gulf of Tartary, as related above, no American vessels have gone there to fish for cod. His success, however, had a very decided effect upon the cod-fishing business in the North Pacific, and in 1865 six vessels sailed from San Francisco to the Okhotsk Sea in pursuit of cod. These were the first American vessels to visit that region on cod-fishing trips; and their sailing evidenced a resolution to begin the business upon a broad commercial basis.

But Captain Turner, who seems to have possessed the spirit and enterprise of a pioneer or discoverer, determined to look for cod-fishing grounds nearer home. Not disheartened by the ill success of the *Alert* in 1863, he sailed for Alaska on the schooner *Porpoise*, of 45 tons, March 27, 1865, and arrived at the Shumagin Islands May 1. He began fishing the same day. Cod were abundant and close inshore. As a result, he returned to San Francisco on July 7 with a fare of 30 tons of fish—something less than a full cargo, which might easily have been secured, only for the desire to market the catch in advance of the arrival home of the vessels that had sailed to the fishing grounds on the Asiatic side of the Pacific. This was the first fare of cod from the Shumagin Islands, a locality since famous in the annals of the Pacific cod fishery.*

The cod-fishing fleet of 1864 was composed wholly of rather small-sized schooners, most of which were originally built in New England for the Atlantic fisheries, but had sailed around Cape Horn to find employment in the business of the Occident. It is remarkable that one of those that crossed the Pacific, sailing about 5,000 miles from home, was only 20 tons, a mere boat in which to make such a voyage, and to return loaded "nearly decks to the water." Following are the names and tonnage (in round numbers) of the fleet: *Equity*, 63 tons; *Flying Dart*, 84 tons; *H. L. Ruggles*, 75 tons; *J. D. Sanborn*, 71 tons; *Mary Cleveland*, 91 tons; *Porpoise*, 45 tons, and *Tacoon*, 20 tons.

The Okhotsk Sea fleet all secured full fares and returned in safety. The fish were small, averaging only about 3 pounds each when dry. But in those early days they were in demand, and sold for from 12½ to 15 cents per pound, a price that gave remunerative returns and the promise of future success for the fishery. There was no lack of cod, and even with the method of fishing with hand lines over the vessel's side then in vogue no difficulty was experienced in filling moderate-sized schooners in a reasonable time.

During the years succeeding the events narrated the Pacific cod fishery has been subject to many fluctuations, changes in methods, etc., until, in 1880, it employed the smallest fleet that has found occupation in it since the catching of cod became a recognized industry of the west coast. These changes are discussed in detail elsewhere; it is only necessary to say here that among them may be mentioned the employment of larger vessels, the discovery of new fishing grounds where somewhat larger fish can be taken, the establishment of fishing stations on shore, and the adoption of the method of dory fishing. Following is a tabulated statement, obtained by Wilcox, of the number of vessels employed each year since 1864, the aggregate tonnage (in round numbers), and the total amount of cured (dry) cod taken, showing at a glance the fluctuation in these elements of the fishery:

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*The statements given above concerning the early history of the Pacific cod fishery were obtained by Wilcox from Captain Turner, to whom we are indebted for many interesting facts not heretofore published.

Year.	No. of vessels.	Aggregate tonnage.	Tons of dried cod.	Year.	No. of vessels.	Aggregate tonnage.	Tons of dried cod.
1865	7	440	350	1878	21	[illegible]	[illegible]
1866	15	[illegible]	[illegible]	1879	10	[illegible]	[illegible]
1867	20	[illegible]	[illegible]	1880	8	[illegible]	[illegible]
1868	10	[illegible]	[illegible]	1881	8	[illegible]	[illegible]
1869	21	[illegible]	[illegible]	1882	15	[illegible]	[illegible]
1870	24	[illegible]	[illegible]	1883	17	[illegible]	[illegible]
1871	16	[illegible]	[illegible]	1884	18	[illegible]	[illegible]
1872	7	793	800	1885	12	[illegible]	[illegible]
1873	12	1,274	910	1886	11	[illegible]	[illegible]
1874	8	[illegible]	885	1887	9	[illegible]	[illegible]
1875	9	847	840	1888*	4	941	784
1876	19	[illegible]	[illegible]				
1877	16	2,270	[illegible]				

* These figures are given by Alexander, and include only the fleet actually engaged in fishing. Besides these the schooner *Czar*, 187 tons, was employed as a tender to the shore fishing stations in Alaska, carrying men and material there in the spring and bringing back the fish taken. She is, therefore, essentially one of the cod fleet. The amount of fish transported by her is given on page [illegible], and is additional to that stated above. The schooner *Unga*, 19.18 tons, was also employed as a tender running between these stations. The combined tonnage is [illegible] tons, and the fish aggregate [illegible] tons.

The following statements give the name, rig, tonnage, dates of sailing and return, fishing ground, and number of fish caught for each vessel of the San Francisco cod-fishing fleet from 1880 to 1888:

Name, rig, tonnage, dates of sailing and return, fishing grounds, catch (in number) of fish, etc., of the San Francisco cod-fishing fleet from 1880–88.

Name of vessel.	Rig.	Tonnage (net).	Date of sailing.	Date of return.	Fishing grounds.	No. of fish taken.
1880.						
Alfred Adams			Mar. 16	May 8	Shumagin Islands	[illegible]
Do			May 17	June [illegible]	do	[illegible]
Do			July 3	Aug. [illegible]	do	[illegible]
Wild Gazelle	Sch.	[illegible]	Apr. 6	Aug. 22	do	[illegible]
Do	Sch.	114.45	Sept. 11	Oct. [illegible]	do	[illegible]
Arago	Sch.	[illegible]	May 2	Sept. 30	Okhotsk Sea	[illegible]
Page	Sch.	[illegible]	May 2	Sept. 4	do	[illegible]
Glencoe	Brg.	[illegible]	May 1	Oct. [illegible]	do	[illegible]
Fremont	Bkn.	[illegible]	May 6	Oct. 10	do	[illegible]
Constitution	Bkn.	[illegible]	May 6	Oct. [illegible]	do	[illegible]
San Luis	Bkn.	275.61	May 17	Oct. 4	do	[illegible]
						[illegible]
1881.						
Alfred Adams			Mar. 21	May 21	Shumagin Islands	[illegible]
Do			June 7	July 29	do	51,000
Do			July 26	Sept. 16	do	51,000
Wild Gazelle	Sch.	[illegible]	Apr. 1	Aug. [illegible]	do	[illegible]
Page	Sch.	[illegible]	Apr. 22	Sept. 13	do	[illegible]
Arago	Sch.	[illegible]	Apr. 27	Sept. 11	Okhotsk Sea	[illegible]
Constitution	Bkn.	[illegible]	do	Oct. 17	do	[illegible]
Glencoe	Brg.	[illegible]	Apr. 30	Oct. 15	do	[illegible]
Fremont	Bkn.	[illegible]	Apr. 30	Sept. 15	do	[illegible]
San Luis	Bkn.	275.61	May 6	Oct. 15	do	[illegible]
						[illegible]
1882.						
[illegible]	Sch.	[illegible]	Mar. 18	Aug. [illegible]	Shumagin Islands	[illegible]
Wild Gazelle	Sch.	[illegible]	do	May [illegible]	do	[illegible]
Do	Sch.	[illegible]	June 2	July [illegible]	do	[illegible]
Do	Sch.	[illegible]	Aug. 12	Oct. 2	do	[illegible]

Name, rig, tonnage, dates of sailing and return, fishing grounds, catch (in number) of fish, etc., of the San Francisco cod-fishing fleet from 1880-88—Continued.

Name of vessel.	Rig.	Tonnage (net).	Date of sailing.	Date of return.	Fishing grounds.	No. of fish taken.
1882.						
Page	Sch.	109.88	Mar. 30	Aug. 24	Shumagin Islands	81,000
General Miller	Sch.	109.75	do	(Lost.)		
R. L. Tiernan	Sch.	142.76	Apr. 5	(Ashore.)	Shumagin Islands	
Dashing Wave	Sch.	141.46	Apr. 20	Sept. 19	do	80,000
Adrianna	Sch.	95.58	May 8	July 6	do	54,000
Isabel	Sch.	175.60	May 12	Sept. 1	Bering Sea	90,000
Tropic Bird	Brg.	172.31	Apr. 20	Sept. 25	do	92,000
Arago	Sch.	170.50	Apr. 15	Sept. 28	Okhotsk Sea	111,000
San Luis	Bkn.	275.61	Apr. 29	Oct. 9	do	185,000
Glencoe	Brg.	169.50	May 4	Oct. 17	do	72,000
Fremont	Bkn.	328.31	May 6	Sept. 28	do	204,000
Constitution	Bkn.	276.62	May 13	Oct. 13	do	140,000
						1,261,000
1883.						
Wild Gazelle	Sch.	108.76	Mar. 30	June 14	Shumagin Islands	62,000
Do	Sch.	108.76	June 21	Aug. 3	do	58,000
Do	Sch.	108.76	Aug. 15	(Lost Aug. 19)		
W. H. Stevens	Sch.	139.44	Apr. 21	July 27	Shumagin Islands	77,000
Dashing Wave	Sch.	141.46	May 7	Sept. 21	do	60,000
John Hancock	Sch.	167.62	Mar. 29	Aug. 22	Bering Sea	75,000
Francis Alice	Sch.	125.29	do	do	do	90,000
Bonanza	Sch.	128.79	Apr. 14	do	do	82,000
Tropic bird	Brg.	172.31	Mar. 30	do	do	97,000
Isabel	Sch.	175.60	Apr. 3	Sept. 10	do	165,000
Arago	Sch.	170.50	Apr. 16	Oct. 5	Okhotsk Sea	98,000
Hera	Sch.	209.47	Apr. 20	Oct. 19	do	180,000
San Luis	Bkn.	275.61	Apr. 24	Oct. 15	do	160,000
Constitution	Bkn.	276.62	do	Oct. 6	do	160,000
Glencoe	Brg.	169.50	Apr. 25	Oct. 27	do	95,000
Fremont	Bkn.	328.31	Apr. 28	Sept. 19	do	165,000
Uma	Sch.	197.92	Apr. 30	Oct. 3	do	116,000
Czar	Sch.	137.13	Oct. 3	Nov. 10	Shumagin Islands	60,000
						1,720,000
1884.						
Dashing Wave	Sch.	141.46	Mar. 22	Aug. 25	Bering Sea	85,000
John Hancock	Sch.	167.62	do	July 27	do	96,000
Wild Gazelle	Sch.	108.76	Sept. 15	(Lost.)	do	
Helen W. Almy	Bk.	298.69	Apr. 2	Sept. 5	do	155,000
Hera	Sch.	209.47	Apr. 9	Oct. 3	Okhotsk Sea	113,000
Arago	Sch.	170.50	Apr. 11	Oct. 7	do	86,000
Isabel	Sch.	175.60	Apr. 13	Oct. 4	do	90,000
W. H. Meyer	Brg.	286.50	Apr. 12	Oct. 9	do	92,000
Tropic Bird	Brg.	172.31	Apr. 20	Oct. 6	do	82,000
Jane A. Falkenburg	Bkn.	286.10	do	Oct. 3	do	132,000
San Luis	Bkn.	275.61	Apr. 30	do	do	[illegible]
Constitution	Bkn.	276.62	do	Oct. 6	do	104,000
Fremont	Bkn.	328.31	May 3	Oct. 1	do	113,000
Glencoe	Brg.	169.50	May 3	Oct. 27	do	42,000
Francis Alice	Sch.	125.29		Oct. 25		41,000
Czar	Sch.	137.13	Mar. 23	June 14	Bering Sea	122,000
Do	Sch.	137.13	June 25	Aug. 14	do	47,000
Do	Sch.	137.13	Sept. 16	Nov. 5	do	36,000
						1,612,000
1885.						
Czar	Sch.	137.13	Mar. 13	Apr. 30	Shumagin Islands	60,000
Do	Sch.	137.13	May 6	June 30	do	120,000
Do	Sch.	137.13	July 19	Sept. 9	do	80,000
Arago	Sch.	170.50	Mar. 27	Sept. 11	do	80,000
Dashing Wave	Sch.	141.46	Apr. 1	June 11	do	100,000
John Hancock	Sch.	167.62	Apr. 1	Aug. 3	do	94,000
Isabel	Sch.	175.60	Apr. 15	Aug. 27	do	85,000
Helen W. Almy	Bk.	298.69	Apr. 15	Sept. 5	Bering Sea	182,000
Constitution	Bkn.	276.62	Apr. 22	Oct. 9	Okhotsk Sea	130,000
Tropic Bird	Brg.	172.31	Apr. 25	Sept. 18	Bering Sea	78,000
Francis Alice	Sch.	125.29	Apr. 29	Aug. 10	Shumagin Islands	35,000
San Luis	Bkn.	275.61	Apr. 30	Oct. 16	Okhotsk Sea	128,000
Fremont	Bkn.	328.31	May 2	Oct. 5	do	125,000
Jane A. Falkenburg	Bkn.	286.10	May 3	Sept. 25	do	150,000
						1,376,000

Name, rig, tonnage, dates of sailing and return, fishing grounds, catch (in number) of fish, etc., of the San Francisco cod-fishing fleet from 1880-88—Continued.

Name of vessel.	Rig.	Tonnage (net).	Date of sailing.	Date of return.	Fishing grounds.	No. of fish taken.
1886.						
Czar	Sch.	137.12	Apr. 1	May 24	Shumagin Islands	98,000
Do	Sch.	137.12	June 18	Aug 10	....do	101,000
Do	Sch.	137.12	Aug. 28	Oct. 10	....do	65,000
Isabel	Sch.	175.60	Apr. 1	Aug. 11	....do	92,000
Francis Alice	Sch.	125.26	Apr. 3	July 15	Bering Sea	69,000
John Hancock	Sch.	107.62	Apr. 13	Aug. 6	Shumagin Islands	86,000
Helen W. Almy	Bark	236.50	...do	Sept. 15	Bering Sea	176,000
Fremont	Bkn.	328.31	Apr. 22	Oct. 4	Okhotsk Sea	141,000
Constitution	Bkn.	276.82	May 4	Oct. 1	....do	84,000
San Luis	Bkn.	375.61	May 9	Oct. 7	....do	102,000
Jane A. Falkenburg	Bkn.	295.10	May 21	Oct. 5	....do	101,000
Dashing Wave	Sch.	141.46	June 12	Sept. 5	Shumagin Islands	80,000
Do	Sch	141.46	Mar. 14	May 30	....do	28,000
Arago	Sch.	176.50	Jan. 7	Sept. 15	....do	76,000
						1,222,000
1887.						
John Hancock	Sch.	167.62	Mar. 20	July 12	Shumagin Islands	76,000
Isabel	Sch.	175.60	Mar. 20	Aug. 25	....do	80,000
Dashing Wave	Sch.	141.46	Apr. 6	Aug. 29	....do	73,000
Arago	Sch.	176.50	Apr. 24	Sept. 4	....do	78,000
Czar	Sch.	137.12	Apr. 2	May 20	....do	125,000
Do	Sch.	137.12	June 11	Aug. 7	....do	98,000
Do	Sch.	137.12	Aug. 25	Oct. *15	....do	75,000
Constitution	Bkn.	276.82	Apr. 12	Aug. 12	Bering Sea	185,000
Fremont	Bkn.	328.31	May 4	Sept. 19	Okhotsk Sea	170,000
Jane A. Falkenburg	Bkn.	295.10	May 29	Oct. 5	....do	142,000
						1,107,000
1888.						
Czar	Sch.	137.12	Mar. 12	May 14	Shumagin Islands	131,000
Do	Sch.	137.12	June 3	Aug. 8	....do	115,000
Do	Sch.	137.12	Aug. 28	Oct. 31	....do	65,000
Dashing Wave	Sch.	141.46	Mar. 16	July 21	....do	68,000
Arago	Sch.	176.50	Apr. 12	Sept. 3	Bering Sea	166,000
Constitution	Bkn.	276.82	Apr. 26	Aug. 20	....do	191,000
Fremont	Bkn.	328.31	May 1	Sept. 19	Okhotsk Sea	165,000
Jane A. Falkenburg	Bkn.	295.10	May 10	Sept. 22	....do	136,000
Isabel	Sch.	175.60	....	(Lost.)	....	....
Eliza Miller	Sch.	142.58	Aug. 30	Oct. 25	Shumagin Islands	71,000
						1,086,000

San Francisco cod fleet, 1888.

Name of vessel.	Rig.	Net tonnage.	Value.	Value of outfit.	No. of fishermen.	Fishing grounds.	Pounds of codfish landed at San Francisco.	Value.
Fishing.								
Arago	Sch.	176.50	$7,000	$6,520	24	Bering Sea	360,000	$9,010
Constitution	Bkn.	276.82	6,000	10,000	25	....do	648,500	18,500
Dashing Wave	Sch.	141.46	8,000	6,000	21	Shumagin Islands	261,500	6,627
Fremont	Bkn.	328.31	15,000	10,000	40	Okhotsk Sea	660,000	16,500
Isabel*	Sch.	175.60	5,000	6,500	19	Shumagin Islands	....	....
Jane A. Falkenburg	Bkn.	295.10	9,000	10,000	36	Okhotsk Sea	544,000	13,600
Freighting.								
Czar†	Sch.	137.12	10,000	1,800	8	Shumagin Islands	1,118,000	27,900
Eliza Miller‡	Sch.	142.58	6,000	1,600	8	....do	....	....
Unga‡	Sch.	30.18	2,000	700	5	....do	....	....
Total	9	1,696.73	73,000	58,800	195	....	2,890,000	96,607

* Lost, with 14 men. † Three trips. ‡ Tender at station.

Capt. Joshua Slocum says that in 1877, being at the Philippine Islands, he conceived the idea of making a cod-fishing voyage to the Okhotsk Sea and carrying his fish back to the islands. He was in the schooner *Pato*, of about 45 tons register. Sailing from the islands in March, he first went to Hongkong, where supplies were taken on board, thence he proceeded to the Okhotsk via Yokohama. Salt and fishing gear were obtained from vessels met with at the Okhotsk and a cargo of 23,000 fish was soon taken. Before sailing on the return voyage, Captain Slocum concluded to take his fare to Portland, Oregon, which he did. This was, so far as we are informed, the first and only fare of salt cod ever landed at that place. Captain Slocum attended to the curing of the fish himself, treating them in the same manner as Bay of Fundy cod are cured on the coast of Maine. The fish were sold at prices varying from 5 to 12 cents per pound, and the voyage on the whole was a profitable one.

History of a cod-fishing firm.—The following notes, which show in detail the varied experiences of a firm that engaged in the cod fishery in the "early days" and still continues the business, are based on reliable statements of those who participated in the events narrated. They throw much light on the history of the business, and lead to a clearer understanding of it. Although cod fishing was begun in 1864, there were as late as 1866 no suitable arrangements for curing the fish and no sufficient knowledge about handling them. At the start the fishery was only an adjunct to some other business.

The late Thomas W. McCollam is said to have been the first on the Pacific coast to establish on a permanent basis a business devoted exclusively to the fish trade. In 1867 he bought his first cargo of cod, and the next year determined to engage permanently in the trade and to conduct the business on the most approved methods. At the beginning he bought and cured several cargoes of cod at Old Sausalito. But the location was not satisfactory and a new station was established at the mouth of Redwood City Creek, about 30 miles south of San Francisco. Here wharves, storehouses, and flake yards were built sufficient for carrying on the curing business, and 5 acres of land were also devoted to it. He visited New England and purchased the fishing schooners *Rippling Wave*, *Wild Gazelle*, and *Flying Mist*. The first was lost on the passage in Magellan Strait; the others arrived safely and were immediately sent to the Shumagin Islands for cod.

The business appears to have been prudently managed, and prospered. In addition to the fish taken by his own vessels he bought many other cargoes. In 1873 a partner was taken into the business, and the firm was then known as Thomas W. McCollam & Co. In 1874 the schooner *Alfred Adams* was added to the cod-fishing fleet. But the same year the *Flying Mist* went to hunt sea otters off Saghalin Island and the coast of Japan, meeting with marked success. The development of the business called for a change of site for the curing station, and in 1876 the firm removed to Pescada Landing, opposite Sausalito, on Richardson's Bay, about 5 miles northwest from San Francisco. Here the firm (now the McCollam Fishing and Trading Company) has continued the curing of cod, though it has its office and salesrooms at San Francisco.

The same year that the curing station was established at Pescada Landing it was determined to introduce a new feature in the cod fishery by establishing a station at one of the Shumagin Islands, where fishermen could live in summer, and from which they could pursue cod fishing in boats, salting their catch in storehouses on shore where the fish could remain in kench until it was suitable to send them to market. Pirate Cove, Popoff Island, was selected. The place had already been occupied by a party of hunters, who had resorted here for several years, and had erected a wharf and two buildings. Cod were abundant near the shore, and the fact that the station is still occupied proves the wisdom of its selection. Three schooners were sent to the station the first year, and their crews worked in conjunction with the men on shore.

In 1883 the three-masted schooners *Hera* and *Una* were sent to the Okhotsk Sea, and the brig *Tropic Bird* sailed for Bering Sea. The latter was a new ground for cod, no vessels having previously gone there in search of this species. The vessels were all successful; their catch, together with that obtained by the men at Pirate Cove, amounted to 630,000 fish, or nearly 1,000 tons. In this year (1883) several new members were admitted into the firm and its name was changed to the McCollam Fishing and Trading Company. The fishing fleet was increased by the purchase of the bark *Helen W. Almy* and brig *Tropic Bird* and by building the schooner *Ounimak*. The business at Pirate Cove, which previously had been confined to supplying employés of the firm, was largely increased. A new building was erected at the Cove, and it was stocked with a large amount of goods suitable to the trade, that were forwarded by the schooner *Czar*. This vessel made three trips during the summer, taking salt, fishing gear, and assorted merchandise to Alaska and bringing home codfish and furs.

Additional new buildings and a new wharf were constructed at Pirate Cove in 1884, and the stock of goods was enlarged and improved in variety. This resulted in making the Cove the headquarters for supplies for residents within a radius of 100 miles, and it also induced many of the fishermen to make their homes there, and now, instead of returning to San Francisco at the close of the fishing season, when their term of engagement expires in the fall, they remain to fish or to hunt for fur-bearing animals during the winter.

The system of fishing from shore stations having been found most profitable, the firm gradually withdrew its vessels. The *Hera* was withdrawn in 1885, the *Tropic Bird* in 1886, and the *Helen W. Almy* in 1887. In the latter year a branch fishing station was established at Pauloff Harbor, Sannak Island. In 1888 the schooners *Czar* and *Eliza*

Report U. S. F. C. 1888.—(To face page 98.) Pacific Coast Fisheries. PLATE XII.

PIRATE COVE, SHUMAGIN ISLANDS, ALASKA.

Miller were employed as tenders to this and the Pirate Cove station, carrying the products to Pescada Landing and returning to Alaska with supplies.

Causes of fluctuations.—The fluctuations and vicissitudes of the Pacific cod fishery are due to several causes. For a long time one of the chief drawbacks was found in the lack of experience on the part of some of those conducting the business. Often they were deficient in the technical skill and knowledge required for properly curing the products landed from their vessels. Firms and individuals that entered into the trade without sufficient knowledge of its requirements soon became discouraged, as a rule, and dropped out of the business; only those with greater skill and more persistence continued the industry. Wilcox pertinently remarks that "those that remain have by long and sometimes by dear-bought experience thoroughly learned all the details of the business and have familiarized themselves with the needs."

Paradoxical as it may seem, for some years a season of exceptional success was often the cause of disaster. Large profits generally created a temporary "boom." Firms or individuals hastened to engage in the fishery. Frequently sufficient care was not exercised in selecting men and vessels. Generally the market was much overstocked at the close of the season. Prices dropped far below the point where they gave remunerative returns to investors. Too often the products could scarcely be sold at any price because of the excess of supply over the demand. The result was necessarily disastrous, and those who had hastened to engage in an enterprise because others had been "lucky" usually abandoned it with the utmost precipitation, leaving the field only to those whose "luck" or experience enabled them to succeed under conditions that ruined or discouraged their competitors. The year 1869 is cited as a fair illustration of the above statements. Serious loss was caused that year by overproduction and improper methods of curing. As a consequence, hundreds of tons of spoiled fish were thrown into the sea. One cargo of 140 tons of cod was brought to San Francisco by a foreign vessel. A duty of one-half a cent per pound was paid on the fish, which, when opened, were in such condition that the whole lot sold for only $500. The fish were shipped around Cape Horn to New York to be used for fertilizing purposes, but arrived in such an offensive condition that they could not be landed; they were taken outside of New York Harbor and thrown into the sea.

The competition arising from the introduction of Atlantic cod in Western markets has possibly had some influence in causing fluctuations in the Pacific cod fishery. But I look upon this rather as the cause of the general decline noticeable in recent years than as a special reason for the variableness alluded to. It is now difficult to predict what may be the ultimate result of this competition, since so many factors are involved, any one of which may have a great influence. The probabilities of counteracting this influence by seeking other markets, etc., are discussed elsewhere.

Present status and importance of the cod fishery.—Compared with former years, when the fleet sometimes numbered upwards of twenty vessels and the products aggregated more than 2,000 tons, the Pacific cod fishery is now unimportant, while it appears at still greater disadvantage if compared with the great cod-fishing industry of the Atlantic States. A particularly unfavorable change in its status took place between 1888 and 1889, as will be seen by reference to the historical notes and tabulated statements given elsewhere. Considered, however, from the standpoint of the needs of the population of the Pacific Slope, the capital invested, the excellent curing stations, and the experience gained, the cod fishery is by no means an unimportant factor in the industries of the far West, and if not abandoned may ultimately attain a status that its present condition gives little reason to hope for.

According to Alexander, "Lynde & Hough were the only firm of San Francisco that had vessels actually engaged in fishing for cod in the season of 1889." They sent the barkentines *Jane A. Falkenburg* and *Fremont* to the Okhotsk Sea (the former sailing May 23 and the latter May 6) and the schooners *Dashing Wave* and *Arago* to Alaskan waters. The barkentines both arrived home on the 25th of September. Their fares aggregated 327,000 fish, equal to 491 tons, valued at $24,550. The combined catch of the two schooners amounted to 195,000 fish, weighing 293 tons, valued at $14,650. These fish were caught about the Shumagin Islands. The *Dashing Wave* landed two fares, the first on June 28 and the second October 8. The firm has a station at Sand Point, Popoff Island, devoted to salmon fishing and outfitting; this is connected with the cod fishery only to the extent that the vessels can, if necessary, land their fares here and refit for another cruise with salt, dories, provisions, etc., which are kept for this purpose as well as for supplying the resident population. This sometimes saves a vessel from making the long trip to San Francisco and back in midsummer, when the fishery is at its height.

During 1889 the McCollam Fishing and Trading Company prosecuted the cod fishery from their shore stations as usual, and had employed the schooner *Unga* (of 20 tons and with a crew of 5 men) as a tender between stations, and the schooner *Czar*, which carried the products to market. The latter made three trips (sailing, respectively, February 11, May 2, and July 10, and arriving home April 16, June 25, and September 1), and brought home an aggregate of 325,000 fish, weighing 490 tons, with a value of $24,500.

The total catch of cod for 1889 amounted to 847,000 fish, weighing 1,274 tons, with a first value of $63,700. The business employed 6 vessels (including 2 used as tenders and freighters), with an aggregate registered tonnage of 1,097.68, and valued at $51,000.

Fishermen, lay, etc.—There have always been a greater or less number of New England fishermen employed in the Pacific cod fishery since it became a recognized industry. In the early days, when the fishery was most lucrative and important, it was not uncommon for whole crews of trained fishermen to sail for California on schooners purchased at New England ports for the trade. These men were peculiarly fitted to wield an important influence on the industry, for they carried to the Pacific a skill gained by years of experience in the Atlantic fisheries, and hardihood and daring unexcelled. But the business has attracted men of various nationalities, particularly Europeans, and Americans are now, and for several years have been, in a decided minority. Thus, in 1888, out of a crew list of 188, only 30 were Americans, 147 were Scandinavians, 8 were born under the British flag, and 3 were Portuguese. There appears to have been even a greater diversity in 1889. Of 35 fishermen selected at random, Alexander states 9 were Americans, 12 Scandinavians, 6 Portuguese, 4 Russian-Finns, 2 Germans, and 2 Irish.

The system of remuneration differs considerably from that generally adopted on the Atlantic coast, resembling the latter only to the extent that, with few exceptions, the amount earned by each fisherman depends upon the quantity of fish taken by him. Some of the men who have special duties receive a monthly stipend and are sometimes paid, in addition, whatever they can earn by fishing. The captain of a cod-fishing vessel going to the Okhotsk Sea usually receives a stated sum (as agreed upon between him and the owners) per 1,000 fish landed, or he may be hired by the month. The mates, of whom there are generally three on the larger vessels, fish in dories the same as the regular fishermen, and are paid a certain amount per 1,000 for their individual catch, the amount being graded according to their respective official positions, and being considerably more than is paid to the crew. Sometimes they are paid a certain amount per month and the same rate for the fish as the ordinary fishermen get.

The fishermen proper, those who hold no official position and devote themselves exclusively to catching fish while on the banks, receive from $20 to $25 per 1,000 cod for all fish which measure 28 inches in length from tip of snout to end of tail. Cod 26 inches long and upwards, but less than 28 inches, count two for one; those less than 26 inches are not counted. Each man's catch is counted and credited to him as he comes on board, and several trips may be made each day, if fish are plenty, since those who go in the dories have nothing to do with dressing or salting.

On each of the large vessels are eight men, comprising two gangs, whose special duty is to dress and salt the catch. These include two splitters, two throaters, two headers or gutters, and two salters. These men remain on the vessel and receive monthly wages, ranging from $15 to $50 or more, the amount paid depending upon the skill and responsibility of the individual. They also have the privilege of fishing over the vessel's rail when not engaged in other duties. They are paid the same rates for their catch as the regular fisherman, and occasionally add considerably to their earnings.

Each vessel has a "watchman," who is paid monthly wages, and, like the dressing gang, receives additional pay for fish caught over the vessel's side. On passages his duties are those of a common sailor; but on the fishing banks no anchor watch is kept by other members of the crew, who sleep at stated hours (that can hardly be called night in high northern latitudes), while the watchman remains alone on deck and keeps the lookout. He thus often has exceptional opportunities for fishing, and two instances are cited when watchmen were "high line," having caught more fish than any one else on board.

The vessel furnishes all boats, fishing gear, bait (if any is carried), and provisions free of any expense to the crew. Clothing, tobacco, or other supplies are advanced from the outfitting stores before sailing, or furnished from the "slop-chest" during the voyage, the price of these being deducted from the earnings of each man at the final settlement.

The lay of the Alaskan stations differs slightly from that above described. The fishermen are paid from $25 to $30 per 1,000 for all their fish, but with the understanding that they must dress and salt all their catch. The system of measuring and counting differs only in the size of the fish from that in vogue on the vessels; the fish are salted in the warehouses. It has been given in evidence before the Senate Committee on Relations with Canada that $27.50 is the price paid by the McCollam Fishing and Trading Company, with the understanding that "counts" should be no less than 26 inches in length; those from 24 to 26 inches to be counted two for one, and all less than 24 inches long to be thrown away. Each station is under the control of an agent of the company that operates it, and his relations to the men are the same as those of the captain of a vessel; he superintends their work, keeps the record of their catch, and furnishes them with such supplies as they may need from the company's store. The fishermen live in comfortable quarters on shore and are provided by the company with everything required for fishing, except gear (including trawl lines), which is paid for at a price fixed upon when the men ship for the season. This rule has been adopted to insure greater care for the gear on the part of the fishermen, but it has not been found necessary on vessels fishing at the Okhotsk Sea and Bering Sea, where hand lines only are employed.

On the vessels fishing in Alaskan waters, according to Tanner—

> The captain is paid a stated sum per month, and has no share in the cargo. The mate receives a monthly salary, and also a certain sum for every thousand fish caught. Each of the crew receives $25 per thousand fish; splitters, $50 per month; salters, $40 per month; cooks, $60 per month. On the return from a trip the crew has nothing more to do with the vessel, taking no part in the discharging of the cargo, which is done entirely at the expense of the owners. The cod livers are never saved, and a profitable portion of the fish is thereby thrown away.

I have been told that a system similar to the above has at times been adopted on vessels going to the Okhotsk Sea.

Mention has been made of the fact—an important one so far as the welfare of the men is concerned—that vessels fishing off the coast of Alaska can refit at the shore stations when necessary. Those fishing at the Okhotsk are not so favorably situated; the fishing grounds are 10 to 40 miles from land, usually off the mouths of small rivers or creeks that empty into barred and inaccessible harbors; the vessels must ride out gales or scud away to sea; wood and water are generally procurable, and occasionally some poor beef or a bear may be obtained, but other provisions or supplies are not available on that bleak and barren coast.

Apparatus, methods of capture, bait, etc.—Hand lines are exclusively used in the Okhotsk and Bering Seas, and the system of "dory fishing" is also in vogue. This method is precisely similar to the dory hand-line fishing for cod on the banks of the western Atlantic. A large number of small dories are carried by each vessel, and a single fisherman goes in each boat. Standing in the center of the dory (which is only about 13 feet long on the bottom and a little over 16 feet on top), he throws out a line on each side, and the fish taken are put into the ends of the craft until she is loaded, when they are taken to the vessel and pitched on deck for dressing. The time occupied in loading a dory varies, according to the abundance of fish, from a few hours to a whole day; sometimes only scattering cod can be taken, not enough to half fill a boat, though this is comparatively rare on Pacific fishing grounds.*

It has been found impracticable to set trawls in Bering Sea. The schooner *Constitution* tried to use them in 1887, and the attempt was repeated by the *Arago* in 1888. But no satisfactory results were obtained, because of the great abundance of sea fleas (amphipod crustaceans) on the bottom. These active scavengers not only swarmed upon the bait, but they injured or devoured the cod before the trawls could be hauled.

The hand lines used are similar to those employed in dory hand-line fishing on the Atlantic, but rigged with less care and neatness. Captain Tanner says:

> The fishing leads are made by the crews of the vessels, and therefore do not compare in finish with those of New England. The lines are not tarred, and soon show signs of wear. Patent swivels are apparently unknown; none of the crew of the *Arago* had ever seen or used them; but after the method of working them and their advantages had been explained the fishermen expressed their intention of giving them a trial next year. The dories correspond in shape and size with those used upon the eastern coast, the only perceptible difference being that the stem, timbers, and planking are a trifle heavier. They are manufactured in San Francisco by Lynde & Hough. Galvanized-iron rowlocks are used instead of thole-pins.

Shore cod fishing is wholly carried on in dories, this method bringing the best returns for the money invested. It would be impracticable to

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*Captain Slocum says that even the inexperienced men he had on the *Pato*, none of whom had previously seen a codfish, easily caught an average of 500 fish per day (earning $12.50) when the fishing was best.

use vessels in this fishery as the cod feed and school so close to the harbors and coast that dories can make several trips daily to the fishing grounds. This method is successfully followed throughout the year, and in 1889 gave employment to 33 men. The winter catch is salted in kench, in the warehouses, and held there until spring, when the freighter arrives to carry the fish to market.

Both trawls and hand lines are used, the former more extensively. The trawls are like those used in the Atlantic cod fishery. The natives at Unalaska have the ordinary type of steel hook for cod fishing, though they still prefer the wooden hooks made by themselves for halibut fishing. Crude and primitive as these hooks are, I am assured by competent authority that they are very effective in catching halibut. Any available material serves the natives as a line for cod fishing. It may be only pieces of old cord knotted together, or a piece of sail or salmon twine, but sometimes cod line is used. Small iron bolts, spikes, or pieces of lead are preferred for sinkers, but stones also serve for this purpose.

Writing of the fisheries at Pirate Cove, which may be taken as fairly representative of all the Alaskan stations, Captain Tanner remarks:

> Cod fishing is now carried on in the vicinity of this harbor almost exclusively by means of dories, only one vessel having been engaged here in actual fishing during the present season. Most of the schooners had been sold, and those retained are used for freighting. The grounds resorted to are all within a short distance of the harbor, where dories are more convenient than larger craft. Trawls are chiefly employed, and during good weather they are hauled two and three times a day, but the fish are not dressed until the last haul for the day has been made. Cod fishing continues throughout the year. In summer, when the salmon are running, cod are not abundant, but they reappear in incredible numbers as soon as the salmon leave. During the winter strong southeasterly gales may prevent the hauling of the trawls for a number of days at a time, but there is no period of the year when they can not be used at least several times a week. This is in marked contrast with the climate of the Grand and Western Banks, off the Atlantic coast, some ten degrees farther south, where the fishing vessels are often compelled to lie to for a week, and sometimes for a fortnight, with their dories lashed upon the deck.

Salmon are extensively used for bait, particularly in the Okhotsk Sea. But halibut, herring, sculpins, flounders, and clams are employed for this purpose and answer well, though less attractive than salmon.* According to Dr. Bean the Alaska pollock "is one of the best baits known for cod." He also says that the Atka mackerel (*Pleurogrammus monopterygius*) possesses rare worth as a bait for cod, while the cusk, a species still rare in museums, forms an element in the bait supply for cod at the Shumagins. He also mentions the lant (*Ammodytes personatus*), which is extremely abundant in most parts of Alaska, and the capelin (*Mallotus villosus*), which is universal and abundant throughout the territory, as very important factors in the bait supply for the cod

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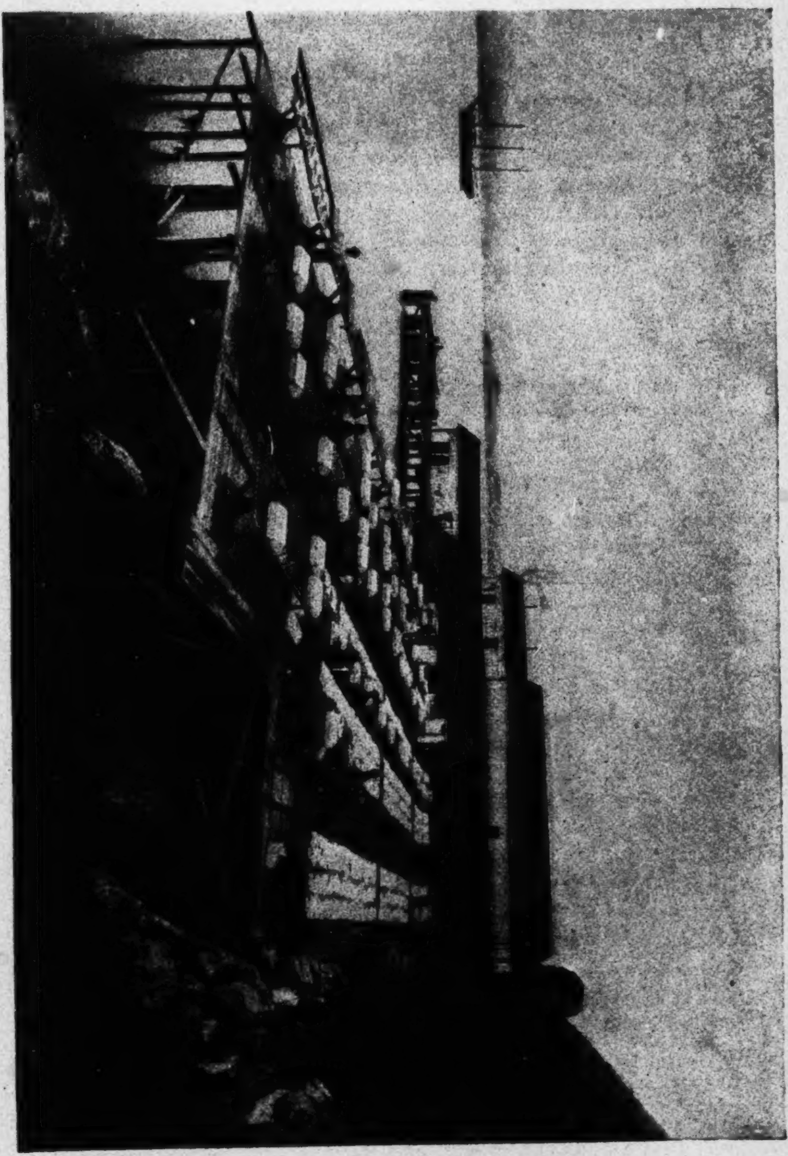
* Those fishing in Bering Sea usually take a few herring to begin with, after which halibut are exclusively used for bait.

PLATE XIII.



CODFISH FLAKE YARD AND CURING STATION, PESCADA LANDING.

fishery of that region. The herring (*Clupea mirabilis*) is "invaluable as bait."*

The Okhotsk Sea fishermen take salmon for bait when they first appear by trolling. But when the fish enter the rivers the vessels must from time to time go inshore and anchor near the mouths of the streams so that their crews can enter to obtain a supply of salmon for bait.† Often, however, when the vessels lay within a reasonable distance of the land (6 to 10 miles off) they do not get under way, but send a dory, with a party of 4 or 5 men, to the land to seek the bait. One or more large dories are generally carried for this purpose, and a small seine (20 to 30 fathoms in length) is a necessary adjunct of a cod-fishing vessel in these waters. Sometimes, but more rarely, salmon may be caught for bait in a gill net set from the vessel's stern on the fishing ground.

Captain Slocum tells me that salmon usually appear in the rivers entering the Okhotsk about the first of July. There are three runs of fish. The humpback salmon enter the rivers first; they are followed some time later by the red salmon, and the silver salmon come last. This refers only to the rivers where salmon are taken by the cod fishermen.

Curing stations and preparation of products.—The two curing stations on San Francisco Bay deserve mention. Pescada Landing is situated along the water, at the foot of a steep hill, on the east side of Richardson's Bay. The plant includes wharves, fish houses, flake yards, quarters for the employés, etc. The main building is two stories, 100 by 220 feet ground plan; the cook house (which includes mess room), 18 by 32 feet; lodging house or dormitory for employés, 16 by 30 feet. Besides these there are several other storehouses, sheds, etc., that afford additional accommodation. There are two flake yards; one is 50 by 150 feet, and the other is 45 by 140 feet. The flakes are like those used in New England. The buildings and flakes are all located over the water and built on piling.

A tank with a capacity of 5,000 gallons is filled with water by a windmill, and the water is carried through pipes by gravitation to all parts of the buildings, thus saving much labor in washing fish, etc. The ground floor of the main building is occupied by large, square, wooden tanks, in which the cod are resalted and are kept in pickle until taken out to be dried. Most of the tanks are each 14 feet long, 7 feet wide, and 6 feet deep. Each holds about 12 tons of fish, but there are also smaller tanks, suited to the place they occupy. The tanks are built of 3-inch plank, and the seams are tightly calked to prevent leaking.

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*The Fishery Resources and Fishing Grounds of Alaska, by Tarleton H. Bean, Section III, Fisheries and Fishery Industries of the United States, pages 81, 82, and 85.

†The rivers in which salmon are taken for bait are known to the fishermen as Little River, Galigan River, and Great River. Cod fishermen seldom go north of the last-named river; they most commonly fish off Little River.

The specially noteworthy feature of the establishment is a system of tramways extending to all parts of the warehouses and flake yards, upon which run platform cars, each carrying from 2½ to 3 tons of fish at a time. The cars can be moved very easily, and the direction can be changed by means of turn-tables. Their use affords a quick and economical method of handling large quantities of fish in a short time. It is a decided improvement over the primitive wheelbarrow and hand-barrow, still unaccountably in general favor on the Atlantic coast.

When a vessel arrives with a cargo of cod she is moored across the end of the wharf and the fish are loaded on the cars. As fast as the cars are filled they are run upon a platform scale, where the weight of fish is noted, and then off to the washing pond or pickling tanks. At other times the cars carry the fish from the tanks to the flake yards, or thence to the packing or skinning rooms.

The manufacture of boneless fish is carried on in the same manner as in the East, and the product is packed in cases and boxes holding 30, 40, 50, and 100 pounds each. The 40-pound boxes are filled with 2-pound packages of boneless cod, known to the trade as "bricks." Unskinned dried cod are sold in 50-pound bundles. The sloop *Star* carries the prepared products to San Francisco and brings to the station such supplies as are needed.

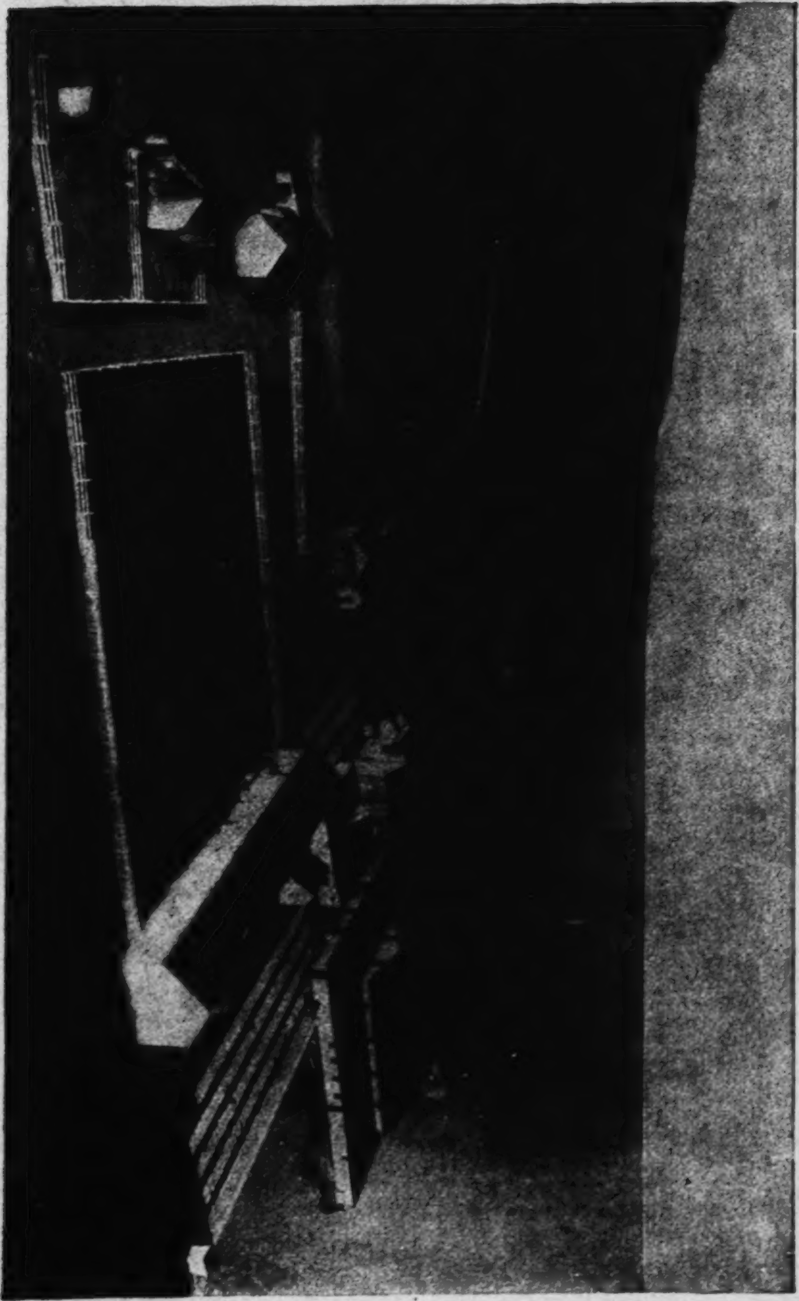
On the second floor of the main building is a sail loft and boat-building shop. Here sails are made or repaired and dories are built.

From 30 to 65 men are employed here in preparing fish for market. All board at the station and eat and sleep in the buildings constructed for those purposes.

The outfitting and curing station, called California City, is very complete, and one of the most remarkable in the country, since it is a settlement composed exclusively of men, not a woman or child living on the premises. It was established by the fishing firm of Lynde & Hough in 1872, and is located on the west side of the bay, nearly opposite Point Richmond, and about 8 miles north of San Francisco. It embraces 50 acres within its limits, most of which is a small and rather flat valley bordering the bay, with hills and steep mountains on its flanks and rear. A pile wharf, at which vessels can discharge their cargoes and refit, is almost wholly covered by an oblong two-story building and the large, low, sloping-roofed sheds that flank it. This storehouse (for sheds and all are part of one structure) has a capacity for 1,200 tons of salted fish, that amount having actually been there at one time, stored in the pickling tanks and casks. Each of the 36 tanks holds 15 tons of fish. They are made of 3-inch redwood plank, dove-tailed at the ends. No iron bolts or nails are used in their construction, because rust would injure the fish. Besides tanks, many large casks or butts are used for pickling fish. On the upper floor of the main building are the sail loft and storage rooms for dories, fishing gear, etc.

There are several other buildings besides the receiving house on the

PLATE XIV.



CALIFORNIA CITY. CURING AND OUTFITTING STATION.

wharf, and there is thus ample room for the preparation of boneless fish, smoking herring or other species, mess room, etc., and for the accommodation of the employés, including a house for the overseer. The two flake yards have a capacity for spreading 9 tons of cod. Salt water for pickling purposes is supplied by a windmill pump on the wharf. Fresh water is obtained from springs on Tiburon Mountain, at the rear of the station. This is brought into a reservoir on the side of the mountain, 180 feet above the wharf, and is distributed thence by pipes that carry the water into the buildings and through the yards. The reservoir has a capacity of 1,500,000 gallons.

The station is provided with the means of furnishing itself with provisions to a considerable extent. A garden yields various kinds of vegetables; 8 cows furnish milk and butter; 150 hens provide eggs and poultry; from the piggery comes fresh and salt pork; grapes can be gathered from the vineyard on the hillside, while all is supplemented by a well-kept flower garden. The buildings and fences are neat and tidy in appearance, and as white as paint and whitewash can make them.

From 30 to 75 men are employed here throughout the year. They are paid monthly salaries and provided with board and lodging. A sailing packet plies between San Francisco and California City, making almost daily trips, carrying such products and supplies as the business may demand at either place.

The production of oil and curing of sounds (swim bladders of cod) do not assume the same importance on the Pacific as on the Atlantic coast. Alexander states:

> Livers and sounds of Alaskan and Okhotsk Sea cod are not considered of much value. The livers could no doubt be used to some commercial advantage, but the fishermen do not seem disposed to bother with what they consider of minor importance. The sound of the Pacific cod differs greatly from that of the Atlantic species. That of the former is very dark, small, and exceedingly thin, and contains little gelatinous substance.

No effort is made to save sounds or livers at Alaska shore stations.

There have been a few attempts (according to Alexander) made to cure fish at the Alaska stations, and some seasons the weather for a short time is suitable for drying, but it can not be relied upon. In view of this fact it would seem that artificial drying machines could be used to good advantage at all the fishing localities of Alaska, and instead of shipping green fish to San Francisco they could be landed ready for boxing and distributing over the country. Such apparatus would be expensive, and probably the demand for Alaskan cod is not at present sufficiently large to induce those engaged in this fishery to risk any large sum in such an enterprise. In years to come, no doubt, the process of artificially drying fish will be looked upon with more favor than at present.

Markets, transportation, etc.—The decline in the Pacific cod fishery is due to a lack of adequate demand or markets; there is unquestionably no deficiency of supply; the fishing grounds are believed capable of furnishing an unlimited amount of cod. It is apparent that no lack of skill in catching or curing the fish militates against their sale. So far as domestic markets are concerned, the Pacific cod is at a disadvantage because of its small size and comparative thinness.* Americans usually prefer large thick cod that are white in flesh when cured. The cod from the western Atlantic banks excel in these particulars, and consequently force smaller or thinner fish out of the market. The result has been the absolute abandonment of the Labrador fishery by American fishermen, since the small cod taken there (which are very similar to the Pacific cod) met with so little demand that the last voyages, made more than a decade ago, were decidedly unprofitable.

Previous to the establishment of railroads to the Pacific, the fish-dealers of that region could defy competition; but with the present facilities for transportation the only advantage the Pacific cod has over its Atlantic competitor is the difference in freight charges to reach the consumer. Nevertheless, it is said that eastern fish are placed upon the market, even in San Francisco, "at a figure which seemingly defies competition." A careful observer thinks that the demand for Atlantic cod, in preference to those caught in the Pacific, may, perhaps, be to some extent due to an indisposition on the part of the San Francisco dealers to force their goods upon the interior of the country. "In the early days of California," he says, "the consumer sought the producer; but that day is past. The New England fish-dealer, a quarter of a century ago, could sit in his office and receive by mail enough orders for fish to satisfy his most ardent wishes; but to-day, in order to procure a fair share of trade, he is compelled to employ men at large salaries to canvass the entire country. If the Pacific dealer would compete with his Eastern neighbor he must use the same means and adopt a like method."

It has been suggested that fish may be artificially dried in Alaska, at the stations where they are caught. This is undoubtedly feasible and seems to offer a solution of an otherwise difficult problem, the maintenance of the Pacific cod fishery. It is reasonable to assume that light-salted hard-cured cod might find a ready sale among the fish-eating populations of Mexico and the countries of western South America. These are easier to reach from California than from Atlantic ports, and for this trade small cod would doubtless be preferable. As a matter of fact, very small fish of the Newfoundland catch, if properly cured, bring a high price and meet with readiest sale in Brazil. If this trade could be once established, so that western South Americans could know where to look for supplies of dried fish, there seems no reason to sup-

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*The average seldom exceeds 3 pounds for cured fish. The standard of excellence can not be gauged by size alone; in some markets small cod are preferred. It is a noteworthy fact that the cheaper grades of the *Gadidæ*, such as hake, haddock, and cusk, do not occur in the Pacific as in the Atlantic. Cod alone are caught and cured in this industry.

pose that it would be disturbed by competition, for the boundless resources of the Northern Pacific in supplying the material, the suitableness of the cod to this market, and the fact that fish can be taken so near the shore, appear to afford advantages not found elsewhere. It may take time to develop the trade, but its apparent ultimate results warrant the attempt. There is seemingly no reason why the fish could not be successfully shipped in sailing vessels (always a cheap method of transportation), as they are still sent to South American countries from Canada and Newfoundland.

Captain Slocum tells me that there is a good market at the Philippine Islands for a limited amount of hard-dried cod, each weighing from 2 to 2½ pounds and packed in tins or tin-lined boxes holding about 25 pounds. He suggests that the packages should be attractive in appearance and neatly labeled in Spanish. Undoubtedly hard-dried boneless cod, packed in "bricks" of 1 to 3 pounds each, may meet with great favor as soon as the people become familiar with fish packed in that way. In 1876 Captain Slocum found the wholesale price of Norway cod at the Philippines to be 12½ cents (or a real) per pound. At that figure only the wealthy people could afford to eat *bacaloa*, but he thinks large quantities would be used by those of limited means if the fish could be sold at a somewhat lower price.

Possibly many people along the Pacific slope might prefer cod prepared as *laberdan* (put up in pickle in barrels) to the dried article. I am not informed whether any attempt has ever been made to introduce this style of curing, for which the Pacific cod are well adapted. If not, its introduction may open new markets. Fish cured in this manner can not, however, usually be safely transported across the tropics, because the pickle sours in the excessive heat. But for ordinary temperatures it keeps well, particularly if a small amount of "preservative" or boracic acid is used with the salt.

THE FUR-SEAL INDUSTRY.*

Importance, etc.—San Francisco is practically the headquarters of the world for the prosecution of the fur-seal industry, which may be fairly considered one of the most important commercial enterprises of the west coast. The Alaska Commercial Company has the privilege, by lease from the United States, to take from the Pribilof Islands, in Bering Sea, 100,000 fur-seal skins annually.† The same corporation is the agent of the lessees of the fur-seal fisheries of the Commander Islands (in the western part of Bering Sea), which belong to Russia, and from this source between 35,000 and 45,000 (occasionally more) pelts are obtained each season and brought to San Francisco.

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*For details of the fur-seal industry see "The Seal Islands of Alaska" (4to), by Henry W. Elliott; "The Fur-Seal Industry of the Pribylof Islands," Alaska, by the same author; and "The Fur-Seal Industry of Cape Flattery, Washington Territory," by James G. Swan. The two latter papers with others relating to the Antarctic fur-seal industry, the sea-otter hunting, etc., may be found on pages 320 to 491, of "Fisheries and Fishery Industries of the United States," section v, volume 2. The paper by Swan relates more particularly to the pelagic sealing from Cape Flattery.

†The term of the lease, which covers twenty years, expired May 1, 1890.

In addition to the important operations of the above-named company, no less than twelve sail of schooners, ranging from about 19 to 98 tons each, were employed from San Francisco in 1888 in pelagic fur-sealing and hunting sea otters, walrus, etc. Their principal business was capturing fur seals. These vessels secured 4,455 seal pelages during the season. The sum total of the fur-seal industry of San Francisco exceeded $1,576,000 in 1888.

Season, etc.—The vessels generally start on a sealing cruise about the middle of January, and the season closes in September or October, at which time they return. They first look for seals off the Golden Gate, but the hunt does not really begin, as a rule, until the vessels are off the Strait of Fuca, and from there they gradually cruise north, following the migratory movements of the herds until they enter Bering Sea. During the summer the vessels frequently engage in hunting walrus and sea otters, to pass away the time until the seals start south again.

Boats.—The boats carried on the sailing vessels are sharp at both ends and similar to whaleboats (indeed some of them are whaleboats) but generally they are smaller; they cost $90 apiece.

Apparatus, methods of capture, etc.—The apparatus used on the islands consists simply of a club for killing and a knife for flaying the seals, unless we include the bones, etc., used for frightening the animals when they are being driven to the "killing ground." On the Pribilof Group only young "bachelor" seals, preferably 3 to 4 years old, are killed for their furs; a few younger seals are slaughtered for food by the Aleuts, this being permitted by the Government. The "holluschickie" usually gather by themselves on the rookeries. The natives select a drove from the herd, and by making noises or otherwise frightening the seals they drive them near the village or to some suitable killing-ground elsewhere, where the animals are knocked on the head, skinned, and the pelts are salted down in kench in a storehouse. Later they are tied in bundles and shipped to San Francisco on the company's steamer *St. Paul*. The driving and killing goes on from day to day during the "season" until the requisite number of skins have been secured.

Rifles and shotguns are chiefly, if not exclusively, used on the open-water sealing vessels, and generally a large quantity of fixed ammunition is carried. In 1886 the revenue cutter *Corwin* took 4 rifles and 1,100 rounds of fixed ammunition from the sealing vessel *Sierra*, and 6 rifles and 500 rounds of ammunition from the *City of San Diego*.

In hunting seals, 3 men go in each boat, but 4 go in a boat for sea otter. The men go out in boats and shoot the seals as they appear at the surface. When one is shot the boat is rowed swiftly toward it, and, if practicable, it is secured; gaffs are often used for this. It is claimed by those familiar with this method, that only a small percentage of the slaughtered seals is secured. Some believe that not more than one in ten is saved, while others think it may be one in four or five. No distinction as to age or sex is made in pelagic sealing; consequently the destruction is great, and its effect on the rookeries is vastly disproportionate to the number of skins obtained. The pelts are salted in the holds of the schooners and kept in kench until the port of discharge is reached; sometimes the skins are sent to market on a "tender" that meets the sealing fleet at some rendezvous for this purpose.

Sea otters are also shot and their valuable skins are very carefully handled.

The only parts of the walrus saved are the hide, tusks, and "whiskers." The hides sometimes weigh as much as 500 pounds apiece, and average about 350 pounds; they sell at 10 cents per pound. Tusks average 7 pounds each; the price is usually 55 cents per pound; they are mostly exported to China, where the bristles are also sent; the latter are used for toothpicks by the wealthy Chinese, and are also mounted with gold and utilized for hairpins by the women of China.

Lay, wages, etc.—Elliot has so fully discussed the system of wages, etc., on the Pribilof Islands, that I will not consider the matter here. The sealing vessels furnish all arms, outfits, and equipment of every kind, including salt, and the men ship on wages or on a lay. If wages are paid, the cook and hunters each receive $50 per month, while the others are paid $30 per month. By the lay system the master receives $\frac{1}{10}$, the mate $\frac{1}{15}$, and the seamen from $\frac{1}{50}$ to $\frac{1}{100}$. The average share is usually small. In 1888 it varied from $30 to $200 for the season.

Statistics.—According to the report (H. Rep. 3883, Fiftieth Congress first session) of George R. Tingle, United States Treasury agent, at the seal islands of Alaska, the number of fur seals killed on the islands of St. Paul and St. George for the year ending July 31, 1888, was 103,920, classified as follows:

Items.	Number.
Young pups for native food	3,[illegible]
For native food during the stagy season when the skin is not merchantable	200
Small young seals killed by natives during food killing	60
Small young seals killed by the Alaska Commercial Company through accident while taking their catch	18
Alaska Commercial Company under contract	100,000
Total	103,920

It will be seen that the full quota of 100,000 skins was obtained at the Pribilof Islands. Add to this the catch of the San Francisco sealers and we have 104,455 pelts as a result of this branch of the American fishery prosecuted from San Francisco. It seems proper to mention in this connection the products received from the Commander Islands, since the fishery there was controlled by American capital. The Russian steamer *Alexander*, which arrived at San Francisco October 12, 1888, brought from the Russian Islands 39,348 skins of fur seals, besides other furs. The entire product received from the Commander Islands in 1888 was 47,362 seal skins.* The total number of fur-seal pelages received at San Francisco during the season of 1888 amounted, therefore, to 151,817, worth, at the low estimate of $10 each, $1,518,170.†

SEA-OTTER HUNTING.

Although the pursuit of the sea otter (*Enhydra marina*) is carried on almost exclusively in Alaskan waters, the business is controlled by San Francisco capitalists, who send out vessels and employ natives to hunt. The industry therefore deserves mention here, and available statistics should be presented.

Recently there has been a decided decrease in the numbers of the sea otter, but the pelage is so valuable (exceeding all others in intrinsic worth)‡ that its pursuit employs a considerable amount of capital and many men at certain seasons of the year. The business is an important one for several months, and is relied upon by some of the Aleuts as one of their principal sources of income. It is difficult to present complete statistics of this branch of the fishery, since the investigation upon which this review is based did not cover the region where the fishery is prosecuted, and for that reason the data relating to boats and men employed are not at hand. Vessels engaged in the sea-otter hunt during fall and winter may at other times be utilized as freighters to visit different stations or else be employed in the salmon fishery.

The total number of sea-otter skins received at San Francisco, as reported by competent authority, amounted in 1888 to 2,510, large and small, and 161 cubs, with an aggregate value of $218,625. In 1889 there were 1,901 skins (including 70 cubs), with a value of $164,775. These figures include 125 skins, valued at $9,375, that were taken on other parts of the coast, and which can not be included under the head of San Francisco products.

Fishing grounds.—The principal localities for the capture of the sea otter are about the reefs and outlying islets of the Aleutian chain of islands. Sannak and vicinity is a favorite hunting ground. Sometimes the kalan is taken in the water, but in heavy storms and gales it is frequently surprised and killed when asleep on the shores or projecting reefs of the islands. Sea otters are also taken occasionally in the vicinity of Cape Flattery or the Strait of Fuca.

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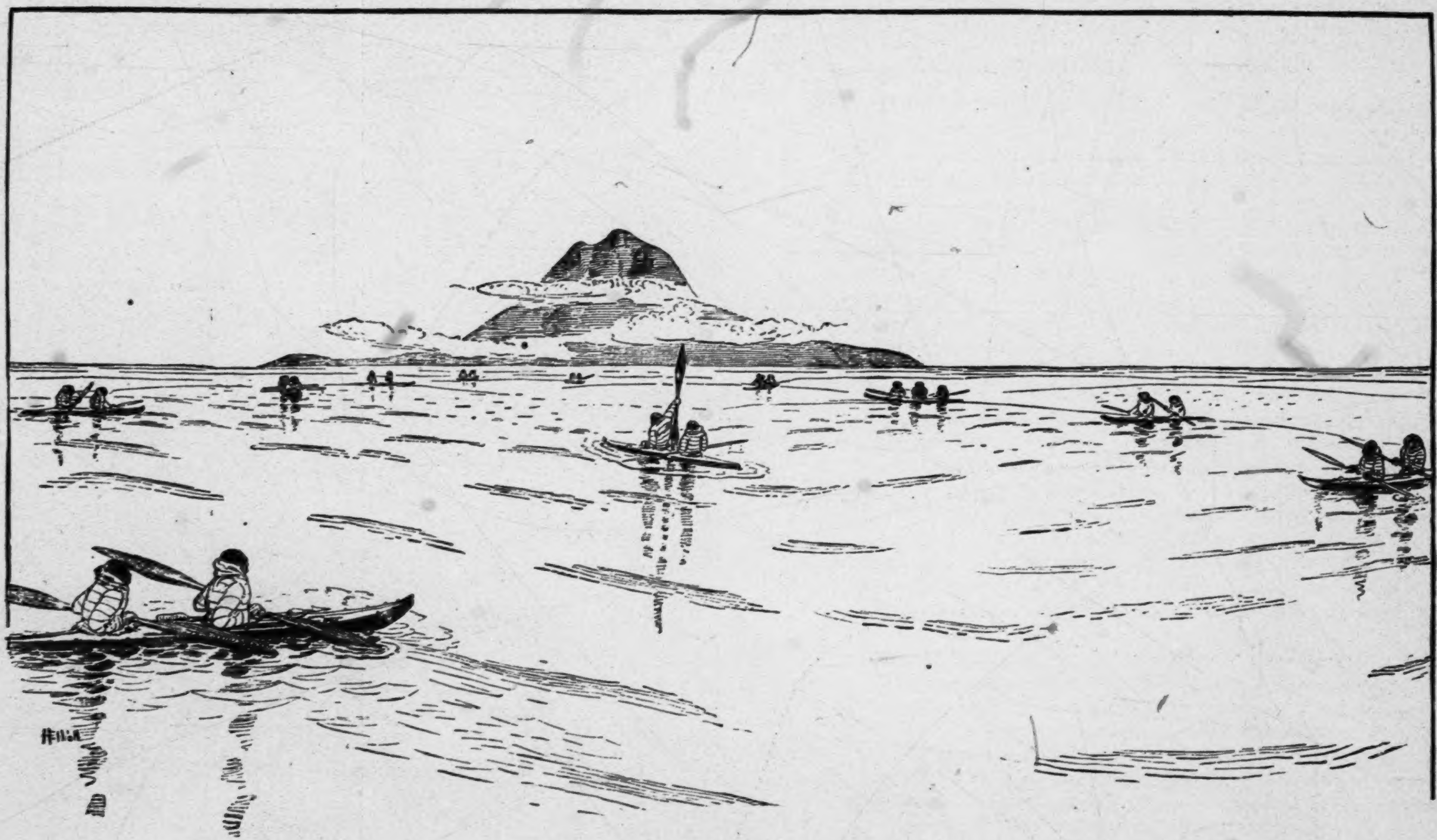
* In 1889 this amount was increased to 52,700, and in 1890 56,000 pelts were received.

† In 1888 and 1889 Alaskan fur-seal skins were worth from $15 to $16 in the London market, while those from the Commander Islands sold for from $11 to $12. The skins are not sold in San Francisco, but the estimate given above is about what they would have brought there had they been put on the market.

‡ In *Land and Water* of August 30, 1890, it was stated that the price of the best pelage of sea otter was from $100 to $300; medium, $50 to $85; brownish, $10 to $25.



SEA-OTTER HUNT. A "SURROUND.

(Drawn by Henry W. Elliott.)

Boats.—The best boat for otter hunting is the two-hole skin bidarka; no other is used by the Aleuts. White men naturally prefer light-built, swift-rowing wooden boats, but they seldom engage personally in hunting this animal, as the life training and inherited habits of the native specially fit him for the work.

Apparatus and methods of capture.—Clubs, spears, and rifles are used for effecting the capture. The two former are the native weapons and until recently have been generally preferred by the Aleuts, because they could be used without noise; but lately the white traders have encouraged the use of rifles, and these have largely superseded the primitive weapons of the natives.

Elliott makes the following interesting remarks concerning the sea otter, and the methods pursued in hunting it:

> The subtle acumen displayed by the sea otter in the selection of its habitat can only be fully appreciated by him who has visited the chosen land, reefs, and water of its resort. It is a region so gloomy, so pitilessly beaten by wind and waves, by sleet, rain, and persistent fog, that the good Bishop Veniaminov, when he first came among the natives of the Aleutian Islands, ordered the curriculum of hell to be omitted from the church breviary, saying as he did so that these people had enough of it here on this earth! The fury of hurricane gales, the vagaries of swift and intricate currents in and out of the passages, the eccentricities of the barometer, the blackness of the fog, enveloping all in its dark, damp shroud, so alarm and discomfit the white man that he willingly gives up the entire chase of the sea otter to that brown-skinned Aleut who alone seems to be so constituted as to dare and wrestle with these obstacles through descent from his hardy ancestors, who in turn have been centuries before him engaged just as he is to-day.
>
> So we find the sea-otter hunting of the present, as it was in the past, entirely confined to the natives, with white traders here and there vying in active competition one with the other in bidding for the quarry of these dusky captors. The traders erect small frame dwellings as stores in the midst of otter-hunting settlements, places like Unalaska, Belcovsky, Unga, and Kadiak villages, which are the chief resorts of population and this trade in Alaska. They own and employ small schooners, between 30 and 100 tons burden, in conveying the hunting parties to and from these hamlets above mentioned, as they go to and return from the sea-otter hunting grounds of Sannak and the Chernabura Rocks, where five-sixths of all the sea otters annually taken in Alaska are secured. Why these animals should evince so much partiality for this region between the Straits of Unimak and the west end of Kadiak Island is somewhat mysterious, but, nevertheless, it is the great sea-otter hunting-ground of the country. Sannak Island, itself, is small, with a coast circuit of less than 18 miles. Spots of sand beach are found here and there, but the major portion of the shore is composed of enormous water-worn bowlders, piled up high by the booming surf. The interior is low and rolling, with a central ridge rising into three hills, the middle one some 800 feet high. There is no timber here, but an abundant exhibit of grasses, mosses, and sphagnum, with a score of little fresh-water ponds, in which multitudes of ducks and geese are found every spring and fall. The natives do not live upon the island because the making of fires and scattering of food-refuse, and other numerous objectionable matters connected with their settlement, alarm the otters and drive them off to parts unknown. Thus the island is only camped upon by the hunting squads, and fires are never made unless the wind is from the southward, since no sea otters are ever found to the northward of the ground. The sufferings, miseries of cold, and even hunger, to which the Aleuts subject themselves here every winter, going for weeks and weeks at a time without fires, even for cooking, with

the thermometer below zero in a wild, northerly and westerly gale of wind, is better imagined than portrayed.

To the southward and westward of Sannak, stretching directly from it out to sea 8 or 10 miles, is a succession of small, submerged islets, rocky and bare, most of them, at low water, with numerous reefs and stony shoals, beds of kelp, etc. This scant area is the chief resort of the kalan, together with the Chernabura Islets, some 30 miles to the eastward, which are identical in character. The otter rarely lands upon the main island, but he is, when found ashore, surprised just out of the surf-wash on the reef. The quick hearing and acute smell possessed by this wary brute are not equaled by any other creatures in the sea or on land. They will take alarm and leave instantly from rest in a large section, over the effect of a small fire as far away as 4 or 5 miles distant to the windward of them. The footsteps of man must be washed from a beach by many tides before its trace ceases to scare the animal and drive it from landing there, should it approach for that purpose.

The fashion of capturing the sea otter is ordered entirely by the weather. If it be quiet and moderately calm to calm, such an interval is employed in "spearing surrounds." Then, when heavy weather ensues, to gales, "surf-shooting" is the method; and if a furious gale has been blowing hard for several days without cessation, as it lightens up, the hardiest hunters "club" the kalan. Let us first follow a spearing party; let us start with the hunters and go with them to the death.

Our point of departure is Unalaska village; the time is an early June morning. The creaking of the tackle on the little schooner out in the bay as her sails are being set and her anchor hoisted causes a swarm of Aleuts, in their bidarkas, to start out from the beach for her deck. They clamber on board and draw their cockle-shell craft up after them, and these are soon stowed and lashed tightly to the vessel's deck-rail and stanchions. The trader has arranged this trip and start this morning for Sannak by beginning to talk it over two weeks ago with these 30 or 40 hunters of the village. He is to carry them down to the favored otter-resort, leave them there, and return to bring them back in just three months from the day of their departure this morning. For this great accommodation the Aleuts interested agreed to give the trader-skipper a refusal of their entire catch of otter skins—indeed, many of them have mortgaged their labor heavily in advance by pre-purchasing at his store, inasmuch as the credit system is worked among them for all it is worth. They are adepts in driving a bargain, shrewd and patient. The traders know this now, to the grievous cost of many of them.

If everything is auspicious, wind and tide the next morning, after sailing, bring the vessel well upon the ground. The headlands are made out and noted; the natives slip into their bidarkas as they are successively dropped over the schooner's side while she jogs along under easy way, until the whole fleet of twenty or thirty craft is launched. The trader stands by the rail and shakes the hand of each grimy hunter as he steps down into his kyack, calling him, in pigeon-Russian, his "loobsiznie droōg," or dear friend, and bids him a hearty good-by. Then, as the last bidarka drops, the ship comes about and speeds back to the port which yesterday morning she cleared from, or she may keep on, before she does so, to some harbor at Sannak, where she will leave at a preconcerted rendezvous a supply of flour, sugar, tea, and tobacco for her party.

If the weather be not too foggy and the sea not very high, the bidarkas are deployed into a single long line, keeping well abreast, at intervals of a few hundred feet between. In this manner they paddle slowly and silently over the water, each man peering sharply and eagerly into the vista of tumbling water just ahead, ready to catch the faintest evidence of the presence of an otter, should that beast ever so slyly present even the tip of its blunt head above for breath and observation. Suddenly an otter is discovered, apparently asleep, and instantly the discoverer makes a quiet signal, which is flashed along the line. Not a word is spoken, not a paddle splashes, but the vigilant, sensitive creature has taken the alarm, and has turned onto its chest, and with powerful strokes of its strong, webbed hind feet has smote the water like the blades of a propeller's screw, and down to depths below and away it speeds, while the hunter brings his swift bidarka to an abrupt standstill directly upon the bubbling wake of the otter's disappearance. He hoists his paddle high in the air and holds it there, while the others whirl themselves over the water into a large circle around him, varying in size from one-quarter to half a mile in diameter, according to the number of boats engaged in the chase.

The kalan has gone down—he must come up again soon somewhere within reach of the vision of that Aleutian circle on the waters over its head; 15 or 20 minutes of submergence, at the most, compel the animal to rise, and instantly as its nose appears above the surface the native nearest it detects the movement, raises a wild shout, and darts in turn towards it; the yell has sent the otter down again far too quickly for a fair respiration, and that is what the hunter meant to do, as he takes up his position over the spot of the animal's last diving, elevates his paddle, and the circle is made anew, with this fresh center of formation. In this method the otter is continually made to dive and dive again without scarcely an instant to fully breathe for a period, perhaps, of 2 or even 3 hours, until, from interrupted respiration, it finally becomes so filled with air or gases as to be unable to sink, and then falls at once an easy victim. During this contest the Aleuts have been throwing their spears whenever they were anywhere within range of the kalan, and the hunter who has stricken the quarry is the proud and wealthy possessor beyond all question or dispute.

In this manner the fleet moves on, sometimes very fortunate in finding the coveted prey; again, whole weeks pass away without a single surround. The landings at night are made without any choice or selection, but just as the close of the day urges them to find the nearest shore. The bidarkas are hauled out above surf-wash and carefully inspected. If it is raining or very cold, small A-tents are pitched, using the paddles and spears for poles and pegs, into which the natives crowd for sleep and warmth, since they carry no blankets or bedclothes whatever, and unless the wind is right they dare not make a fire, even to prepare the cherished cup of tea, which they enjoy more than anything else in the world, not excepting tobacco. After ninety or a hundred days of such employment, during which time they have been subjected to frequent peril of life in storm, and fog-lost, they repair to the rendezvous agreed upon between the trader and themselves, ready and happy to return for a resting-spell to their wives, children, and sweethearts in the village whence we saw them depart. They may have been so lucky as to have secured forty or fifty otters, each skin worth to them at least $50 to $60, and, if so, they will have a prolonged season of festivity at Unalaska, when they get back. Perhaps the weather has been so inclement that this party will not have taken a half-dozen pelts; then gloomy, indeed, will be the reception at home.

While the "spearing surround" of the Aleutian hunter is orthodoxy, the practice, now universal, of surf-shooting the otter is heterodoxy, and is so styled among these people, but it has only been in vogue for a short time, and it is primarily due to our traders, who, in their active struggle to incite the natives to a greater showing of skins, have loaned and have given, to the young hunters in especial, the best patterns of rifles. With these firearms the shores of many of the Aleutian channels, Sannak, and the Chernaburas are patrolled during heavy weather, and whenever a sea otter's head is seen in the surf, no matter if a thousand yards out, the expert, patient marksman shoots seldom in vain, and if he does miss the mark he has a speedy chance to try again, for the great distance and thunderous roar of the breakers prevent the kalan from hearing or taking alarm in any way until it is hit by the rifle bullet. Nine times out of ten when the otter is thus struck it is in the head, which is all that the creature usually exposes. Of course such a shot is instantly fatal, so that the hunter has reason to sit himself down with a long landing-gaff and wait securely for the surf to gradually heave the prized carcass within his ready reach.

Last, but most exciting and recklessly venturesome of all human endeavor in the chase of a wild animal, is the plan of "clubbing." You must pause with me for a brief interval on Sannak to understand, even imperfectly, the full hazard of this enterprise. We can not walk, for the wind blows too hard—note the heavy seas foaming, chasing, and swiftly rolling by, one after the other—hear the keen whistle of the gale as it literally tears the crests of the breakers into tatters, and skurries on in sheets of fleecy vapor, whirring and whizzing away into the darkness of that frightful storm which has been raging in this tremendous fashion, coming from the westward, during the last three or four days without a moment's cessation. Look at those two Aleuts under the shelter of that high bluff by the beach. Do you see them launch a bidarka, seat themselves within, and lash their kamlaykas firmly over the rims to the man-holes? And now observe them boldly strike out beyond the protection of that cliff and plunge into the very vortex of the fearful sea, and scudding, like an arrow from the bow, before the wind, they disappear almost like a flash and a dream in our eyes!

Yes, it looks to you like suicide; but there is this method to their madness: These men have, by some intuition, arrived at an understanding that the storm will not last but a few hours longer at the most, and they know that some 10 or 20 or even 30 miles away, directly to the leeward from where they pushed off, lies a series of islets, and rocks awash, out upon which the long-continued fury of this gale has driven a number of sea-otters that have been so sorely annoyed by the battle of the elements as to crawl there above the wash of the surf, and, burying their globose heads in heaps of sea-weed to avoid the pelting of the wind, are sleeping and resting in great physical peace until the weather shall change; then they will at once revive and plunge back into the ocean without the least delay. So our two hunters, perhaps the only two souls among the fifty or sixty now camped at Sannak who are brave enough, have resolved to scud down on the tail of this howling gale, run in between the breakers to the leeward of this rocky islet ahead of them, and sneak from that direction over the land and across to the windward coast, so as to silently and surely creep up and on to the kelp-bedded victims, when, in the fury of the storm, the fast-falling footsteps of the hunter are not heard by the active yet somnolent animal ere a deadly whack of his short club falls upon its unconscious head. The noise of such a tempest is far greater than that made by the stealthy movements of these venturesome natives, who, plying their heavy, wooden bludgeons dispatch the animals one after another without alarming the whole number. In this way two Aleutian brothers are known to have slain 78 otters in less than one hour.

If these hardy men, when they pushed off from Sannak in that gale, had deviated a paddle's length from their true course for the islet which they finally struck, after scudding 20 or 30 miles before the fury of wind and water, they would have been swept on and out into a vast marine waste and to certain death from exhaustion. They knew it perfectly when they ventured, yet at no time could they have seen ahead clearly, or behind them, farther than a thousand yards. Still, if they waited for the storm to abate, then the otters would all be back in the water ere they could even reach the scene. By doing what we have just seen them do, they fairly challenge our admiration for their exhibit of nerve and adroit calculation, under the most trying of all natural obstruction, for the successful issue of their venture.

In conclusion, the writer calls attention to a strange habit of the Aleutian otter-hunters of Attu, who live on the extreme westernmost island of the grand Alaskan archipelago. Here the kalan is captured in small nets,* which are spread out over the floating kelp-beds or "otter-rafts," the natives withdrawing and watching from the bluffs. The otters come out to sleep or rest or sport on these places, get entangled in the meshes, and seem to make little or no effort to escape, being paralyzed, as it were, by fear. Thus they fall an easy prey into the hands of the captors, who say that they have caught as many as six at one time in one of these nets, and that they frequently get three. The natives also watch for surf-holes or caves awash below the bluffs; and, when one is found to which a sea otter is in the habit of going, they set this net by spreading it over the entrance, and usually capture the creature, sooner or later.

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* Sixteen to 18 feet long, 6 to 10 feet wide, with coarse meshes; made nowadays of twine, but formerly of seal and sea-lion sinews.

No injury whatever is done to these frail nets by the sea otters, strong animals as they are; only stray sea lions and hair seals destroy them. There is no driving an otter out upon land if it is surprised on the beach by man between itself and the water; it will make for the sea with the utmost fearlessness, with gleaming eyes, bared teeth, and bristling hair, not paying the slightest regard to the hunter. The Attu and Atka Aleuts have never been known to hunt sea otters without nets, while the people of Unalaska, and those eastward of them, have never been known to use such gear. Salt-water and kelp appear to act as disinfectants for the meshes, so that the smell of them does not repel or alarm the shy, suspicious animal.

The following tabulated statement gives the figures for the pelagic fur-seal fishery and sea-otter hunting in 1888. The walrus and sea lions taken incidentally are also included:

San Francisco fur-seal and sea-otter fleet in 1888.

Name of vessel.	Rig.	Tonnage.	Value of vessel.	Value of outfit.	No. of crew. (*)	No. of boats.	Number of animals killed.†				Gross stock.	Average share of crew.
							Fur seals.	Sea otters.	Sea lions.	Walruses.		
Alexander	Sch.	49.82	$6,500	$2,000	16	4	220	56	......	......	$6,820	$150
Angel Dolly	Sch.	18.82	2,500	2,550	10	3	17	......	1	10	1,050	60
Annie	Sch.	25.27	2,500	2,000	12	3	1,193	......	......	......	6,794	200
City of San Diego	Sch.	66.16	4,000	3,000	15	4	363	34	......	......	6,000	42
Helen Blum	Sch.	62.67	10,000	4,000	26	7	200	140	......	......	10,000	166
Laura	Sch.	19.30	1,400	1,800	16	3	9	......	......	35	1,500	75
Lily L	Sch.	63.42	5,000	5,000	21	6	1,700	......	......	......	6,360	125
Mary H. Thomas	Sch.	93.66	12,000	4,000	26	7	20	60	......	......	5,000	75
O. S. Fowler	Sch.	32.66	3,000	2,300	15	4	396	......	......	40	4,186	125
Otter	Sch.	78.75	10,000	3,000	18	4	70	80	......	......	6,500	90
San José	Sch.	51.96	5,000	2,000	13	4	150	15	......	......	3,300	12
Vanderbilt‡	Sch.	92.67	5,300	2,000	26	7	167	11	......	....	1,335	30
Total	12	630.82	66,900	37,800	213	56	4,455	§396	1	‖84	69,255	......

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* The nationality of the fishermen was as follows: United States, 141; Sweden, 18; Norway, 10; Japan, 3; British Provinces, 12; other countries, 29.

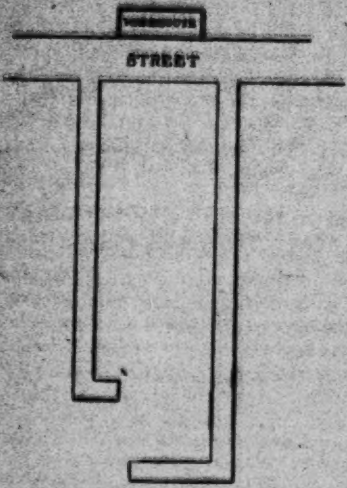
† In addition to the regular catch, 11 bear skins and 39 fox skins were landed by the fleet.

‡ Lost in September.

§ The figures given here apply only to the number of sea otters obtained by these vessels. The total number of sea-otter skins received at San Francisco (which is practically all that are taken on the coast) in 1888, as reported by the Alaska Commercial Company, was 2,510, large and small, and 161 cubs, the whole having a value of $212,625. The number and value of those which can properly be assigned to the fisheries of San Francisco are shown elsewhere.

‖ In addition to these figures, the whale fleet took 36 walruses, the hides of which were valued at $800, and ivory valued at $866. The gross stock includes $647, the value of 1,176 pounds of walrus ivory taken by 3 vessels.

THE MARKET FISHERY AND FRESH-FISH TRADE.



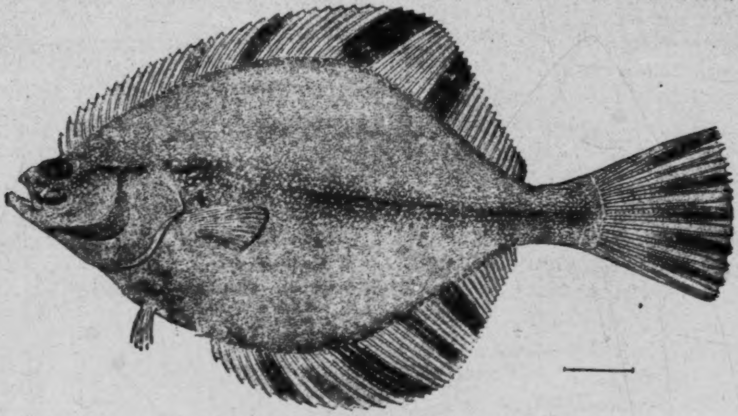
Plan of market dock, San Francisco.

The market fishery of San Francisco, which practically includes nearly all of the fresh-fish fisheries of the region under consideration (except the salmon fishery for canning), is an important industry. Aside from the commercial value of the fishery, as a business enterprise, its importance to citizens of San Francisco in supplying them with a cheap and valuable food can scarcely be overestimated. The people depend so much upon this special industry for fresh food from day to day, that too much care can not be bestowed upon its proper conduct.

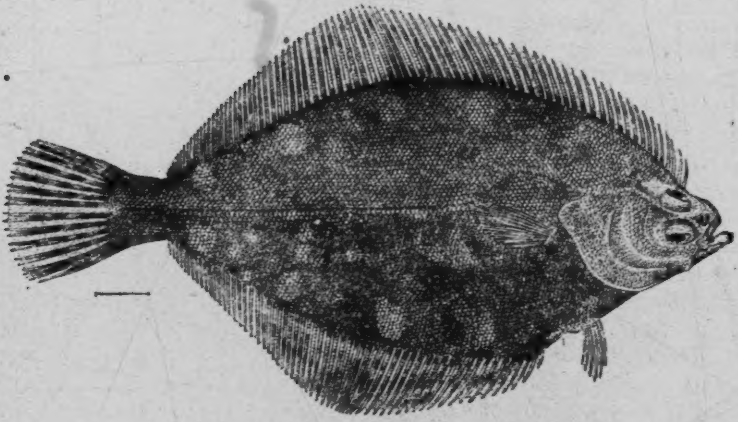
While the market supply of fresh fish and other aquatic animals is largely the product of the San Francisco market fishery (including the Chinese fishing in the bay), important shipments are received from other localities; therefore, while this chapter deals only with the market fishery in a somewhat local sense, incidental allusion to other sources of supply can not well be avoided. This branch of the fishery is of such consequence that a special dock (with wharves, storehouse, etc.), for the accommodation of market boats, the landing of their fares, etc., has been built by the State, and is under the control of the harbor commissioners. It is located between Union and Greenwich streets, at the north end of the city front, and is known as "The Fisherman's Wharf." It was assigned to their use in 1884. It consists of two wharves, inclosing a dock or basin more than 400 feet long and 136 feet wide. One of the piers is 458 feet long by 24 feet wide, with an L at the end 119 feet long, extending across the outer part of the basin; the other is 306 feet long, and is so arranged that there is an entrance 70 feet wide between it and the L of the other wharf. In this inclosed dock boats lie safely at all times. On each pier are railings for drying nets, and just across the street, at the upper (or shore) end of the dock is a storehouse about 100 feet long by 35 feet wide, devoted exclusively to the storage and repair of fishing apparatus.

Species in the San Francisco markets, abundance, seasons, etc.—The San Francisco markets are supplied with a large variety of fresh fish and

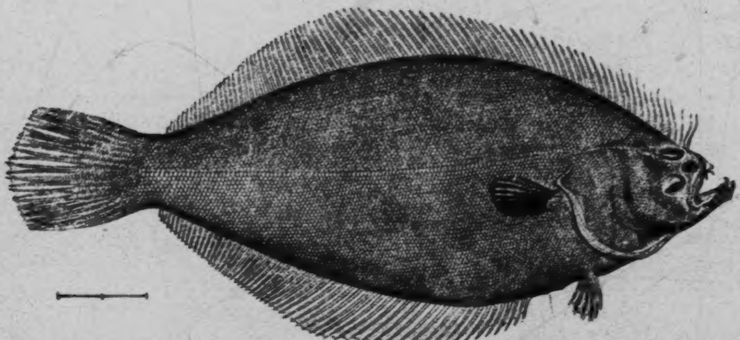
Report U. S. F. C. 1888.—(To face page 119.) Pacific Coast Fisheries. PLATE XVI.



THE CALIFORNIA FLOUNDER (*Platichthys stellatus*).



THE CALIFORNIA "SOLE" (*Lepidopsetta bilineata*).



THE SAN FRANCISCO SOLE (*Psettichthys melanostictus*).

other aquatic animals. Those mentioned below are most commonly taken by the market fishermen of this region.*

Flounders of several species are common in the market. The term "flounder" is specially applied to *Pleuronectes stellatus*. In discussing the flatfishes of the Pacific, Jordan says:

> This species is known wherever found as the "flounder," all others being considered as bastard or false flounders. At San Francisco the name flounder is rarely used in a generic sense, but only as a special appellation of this species. It reaches a length of nearly 3 feet and a weight of 15 to 20 pounds, larger individuals being found northward than southward along the coast. The average length in the market is about 15 inches, and the weight 2 or 3 pounds. (The Fisheries and Fishery Industries of the United States, section I: The Food-Fishes of the United States, by G. Brown Goode, p. 184.)

Wilcox states that most of the numerous varieties of flatfishes found in the San Francisco market are now (1888) known by the common term of flounder, though he says that the trade names of "San Francisco sole," "Bay sole," or "English sole" are applied to one species—"the best of the flounders"—which is probably *P. stellatus*, but may be one or more of the other varieties. The diamond flounder (*Hypsopsetta guttulata*) is commonly known as the "turbot" at San Francisco. There are several species known to the fishermen and marketmen as "soles." Among these may be mentioned *Lepidopsetta bilineata*, *Parophrys vetulus*, *P. isolepis*, *Citharichthys sordidus*, *Psettichthys melanostictus*,† *Hippoglossoides jordani*,‡ *H. exilis*, and the "slippery sole" (*Cynicoglossus pacificus*). The two latter are taken chiefly in the paranzella. Sometimes great catches of *H. exilis* are made off Point Reyes in spring. Generally speaking, flounders and soles are abundant all the year, or sufficiently so to keep the market well supplied.

The common halibut (*Hippoglossus hippoglossus*) is rarely taken by the market fishermen, though the trawlers occasionally bring in a few, "and sometimes a vessel ventures to make a trip for fresh halibut to the northern banks." Lack of active demand prevents any systematic effort to supply the city with this species. The bastard halibut (*Paralichthys californicus*) is taken with other flatfish. The flounders sell at from 3 to 10 cents and the sole at from 6 to 10 cents per pound. The tomcod (*Microgadus proximus*), which Professor Jordan says is usually served under the name of "smelt" in San Francisco restaurants, is taken all the year, selling at from 6 to 10 cents per pound.

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*The scientific names are given to most of the species to avoid misunderstandings that might arise from the local use of common names, many of which are so applied as to give no clue to their meaning, unless one is familiar with the idioms of the marketmen. The retail prices only are given, unless otherwise specified.

†Jordan says: "This species is everywhere a sole, and at San Francisco it is considered to have a better claim to that title than other species."

‡"This species is known universally as the 'sole.' I have also heard the Italian name 'soglia' applied to it more often than to related species."—*Ib.*

The rock-cod or rockfish, of which there are many kinds, occur throughout the year, and sell at from 4 to 10 cents per pound. The following species are commonly called rock-cod: The "scorpene" (*Scorpæna guttata*), black-banded rockfish (*Sebastichthys nigrocinctus*), garrupa (*S. nebulosus*), flesh-colored garrupa (*S. carnatus*), red garrupa (*S. caurinus* and subsp. *vexillaris*), grass rockfish (*S. rastrelliger*), "vermilion fish" (*S. chlorostictus*), corsair (*S. rosaceus*)*, spotted corsair (*S. constellatus*), called also pink-spotted rock-cod. The red rockfish or rough red rock-cod (*S. ruber*) "is usually the 'red rockfish' *par excellence*," according to Professor Jordan. The rasher (*S. miniatus*) and the orange rockfish (*S. pinniger*) of Jordan are now commonly called "smooth red rock-cod" in San Francisco. The black rockfish (*S. mystinus*) is the most abundant species of this genus in the city markets, taking the year through, but owing to a prejudice against its color it does not sell at so high a price as the others. *S. melanops* is usually confounded with *S. mystinus*; it is far less common at San Francisco. The yellow-tail rockfish (*S. flavidus*) is another very abundant species and completes the list of those specially important.

The sea trout, or rock trout (*Hexagrammus decagrammus*), is abundant all the year, and sells at 6 to 10 cents per pound. The cultus-cod (*Ophiodon elongatus*), often called "codfish" here, is taken at all seasons; it sells for from 5 to 10 cents per pound. The ordinary weight ranges from 10 to 15 pounds, but individuals of 40 pounds are sometimes caught. Many small fish of this species are taken in nets in the bay, but the bulk of the catch is obtained on trawls set outside of the Golden Gate, along the coast and off the Farralones. The black "candlefish" or "black-cod" (*Anoplopoma fimbria*) is commonly known as the candlefish at San Francisco, where it is sometimes sold as Spanish mackerel. It is not so large nor so plentiful as farther north, particularly in the Strait of Fuca, and is little esteemed generally.

The term "perch" is applied to many species of the surf-fish family (*Embiotocidæ*) found at San Francisco, but Professor Jordan thinks this an unfortunate misnomer. Among these Wilcox mentions only the black surf-fish of Jordan (*Ditrema jacksoni*), which he designates as salt-water perch or "porgee." This is the most abundant species and the most common of the "perches" in the markets. It is taken all the year and sells at from 3 to 8 cents per pound. Jordan mentions fourteen other species belonging to this family of surf-fishes that occur at San Francisco, but some of them are of little commercial value and in some instances are used only for bait. The river perch (*Hysterocarpus traski* Gibbons) is taken in fresh water, chiefly in the Sacramento and San Joaquin Rivers. Considerable quantities are sold in San Francisco, which are mostly consumed by the Chinese.

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* An excellent food-fish and very abundant on outside grounds resorted to by trawlers.

Mackerel (*Scomber colias*), according to Wilcox, occur from October to the middle of December, but are scarce. Their northern limit of migration is Monterey Bay; the price varies from 10 to 20 cents per pound, and they weigh 2 or 3 pounds each. In October, 1889, when the species was rare in the market, Dr. Bean found it selling at 30 to 50 cents per pound.

The Spanish mackerel (*Scomberomorus concolor*) is rare, and only a few are seen in the markets during August and September. It is highly prized, and sells readily at from $2 to $3.*

The bonito (*Sarda chilensis*) is abundant in its season, June to September, but not in much demand, selling at 15 to 50 cents each. It averages 12 pounds in weight.

The "horse mackerel" or scad (*Trachurus picturatus*) averages 3 pounds in weight, according to Wilcox, and is in market most of the year. The price ranges from 8 to 20 cents per pound. Professor Jordan places its northern limit of migration at Monterey, which locality it reaches in August. He says its weight is less than a pound, and in 1879 found it to be held in low esteem as a food-fish, though he did not know whether this was due entirely to its small size. The estimation of its value seems to have changed materially in the past decade.

The California pompano (*Stromateus simillimus*) is closely related to the butterfish of the Atlantic. It was very rare prior to 1870, but about 1879 was often found in such quantities that the catch could not all be sold. It is again very scarce, but a few are taken from June to August and are in demand at a price varying from 50 cents to $1.50 per pound. The fish is known both as pompano and butterfish in the San Francisco market.

The sea bass (*Cynoscion nobile*), sometimes called "white sea-bass," or when young, "sea trout," is one of the most valued and important species on the coast; it is caught from July to November; it averages about 15 pounds in weight; its price ranges from 1 to 10 cents per pound.

The little bass of San Francisco (*Genyonemus lineatus*) "often comes into the markets in large numbers," according to Jordan, who says that many are dried by the Chinese.

The kingfish (*Seriphus politus*), also called the queenfish, occurs all the year, but is specially abundant in summer, at which time it schools in great numbers in the surf along sandy beaches. Its price varies from 4 to 7 cents.

The Sacramento perch (*Archoplites interruptus*) "is known only by the name of 'perch.'" It is taken in great numbers from October to March in the lower reaches of the Sacramento and San Joaquin Rivers, and is shipped to San Francisco, where it sells at from 4 to 8 cents per pound.

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* The term "Spanish mackerel," as used in San Francisco markets, is commonly applied to the bonito, also called "skipjack," and "tuna" or horse mackerel. The true Spanish mackerel (*S. concolor*) is not caught north of Monterey Bay, where a few are occasionally taken in late summer or fall.

The "jewfish," or "black sea-bass" (*Stereolepis gigas*), is said to be an excellent food-fish, and the smallest are in demand in the market. It is generally plentiful in deep water about the Farralone Islands, but comparatively few are brought to market because of its great size. It is the largest food-fish on the coast; its maximum weight is about 500 pounds.

The striped bass (*Roccus lineatus*), which was artificially introduced into western waters about 1885, is now quite abundant, and may be included among the finest of the California market fishes.[*]

The barracuda, one of the most common food species, is in season from June to September; the price ranges from 4 to 12 cents per pound.

Salmon of several species and of varying excellence are found in the San Francisco markets. They constitute important objects of fishery and are taken in the bays and rivers of the region under discussion. Except, perhaps, in September, the markets are generally supplied with some kind of salmon, for shipments are received from various points along the northern coast. These include the quinnat or king salmon (*Oncorhynchus chouicha*), the silver salmon (*O. kisutch*), dog salmon (*O. keta*), humpback salmon (*O. gorbuscha*), and steelhead (*Salmo gairdneri*). The price ranges from 15 to 12 cents per pound. The black-spotted trout or "lake trout" (*S. purpuratus* var. *henshawi*) is in season from October to March, and in good demand, selling for from 18 to 25 cents per pound.

Smelt (*Atherinopsis californiensis, Osmerus thaleichthys, O. attenuatus*, and *Hypomesus pretiosus*) are most abundant from January 15 to September, though a few are seen in the markets in the intervening months. The largest catch is made in February, March, and April. Alexander remarks that "smelt-fishing is followed about 7 months in the year. It usually begins in February and is assiduously prosecuted till the middle of September, and not infrequently October is well advanced before the season is over." *A. californicus* is alone called smelt in this region. It grows to a large size, attaining a weight ranging from one-third of a pound to a pound.[†] After the principal run is over, silversides or sand-smelt of smaller size are taken with other species. The price is from 6 to 10 cents per pound.

The herring (*Clupea mirabilis*) is exceedingly abundant in its season, from October or November to about March 15,[‡] and, judged by the quantity disposed of, it is one of the most important species. It is sometimes taken in such quantities in San Francisco Bay in spring that 60 pounds can often be bought for 20 cents.* The market price, however, generally varies from 3 to 6 cents per pound.

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[*] Alexander states that in March and April, 1890, it had "recently been taken in such quantities that the price was reduced to 18 cents per pound." The ruling price prior to that time was $1 per pound.

[†] Jordan says of *O. thaleichthys* that "This species is known as smelt, especially in those parts of the coast where the *Atherinopsis* or California smelt is unknown."

[‡] If the weather is dry and warm, herring do not remain so late in the spring, but if the season is wet and cold they are caught until the middle of March.

The California sardine (*C. sagax*) is said to be almost exactly identical with the sardine of Europe. This is an important fact, as will appear in the discussion, in a subsequent chapter, of the preparation of sardines on this coast. It is taken here from May to November, and its market price is from 3 to 6 cents per pound.

The shad (*C. sapidissima*) is not indigenous to the waters of the Pacific coast, but has been artificially introduced there by the U. S. Fish Commission. The species shows a yearly increase, but is not yet abundant; it is taken chiefly in salmon nets, from April to December, and a few are seen in the markets throughout the year. The catch varies considerably from year to year. It often reaches a weight of 8 pounds, and averages between 4 and 5 pounds. The average price has been about 10 cents per pound.

The anchovy (*Stolephorus ringens*) is about half as large as the herring, and is an excellent food-fish as well as an important bait species. It is sold fresh in the market at from 3 to 5 cents per pound; when abundant and cheap it is salted for bait, to be used when fresh bait can not be obtained. Attempts to pickle it in spices for the trade were made as early as 1879, but it is only in recent years that any considerable quantities have been packed this way in half barrels, kegs, and tin cans. During 1888 the experiment of packing them in oil, as "sardines," was tried. Only a small amount was treated in this way, but it is said to have met with favor, and it is believed the experiment may lead to important results.

The sucker (*Catostomus occidentalis*) is a fresh-water species taken in considerable quantities at all seasons, but is little esteemed, the retail price being only about 2 cents per pound.

The "chub" of the San Francisco markets (*Phoxinus crassicauda*) is abundant in the Sacramento River at all seasons. It is one of the cheapest species, selling for from 1 to 3 cents per pound, and is eaten chiefly by the Chinese.

The Sacramento "pike" (*Ptychochilus oregonensis*) and another species (*P. harfordi*) are taken in the rivers of this region, particularly in the Sacramento. Many are brought to market, but they are coarse fish and in little demand outside of the Chinese quarter.

The "split-tail" (*Pogonichthys macrolepidotus*) and two other fresh-water species (*Lavinia exilicauda* and *Orthodon microlepidotus*) abound in the streams of this region and, like those last mentioned, are sold chiefly to the Chinese.

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* Wilcox states that "herring, sardines, and anchovies are taken in abundance in San Francisco Bay. The herring are about 8 inches long, five weighing a pound; prices vary with the catch. Sardines are somewhat larger than herring and run in schools by themselves."

The German carp (*Cyprinus carpio*), originally introduced by the U. S. Fish Commission, is now abundant at all seasons; it sells at from 3 to 8 cents per pound. From 75,000 to 100,000 pounds are annually disposed of in the San Francisco market.

The fresh-water catfish (*Amiurus nebulosus*) is another market species brought from the East. Its price varies from 5 to 10 cents per pound.

Eels are scarce all the year and are in much demand, the price ranging from 50 to 75 cents each.

The white sturgeon (*Acipenser transmontanus*) is abundant and meets with a good demand at all seasons, selling at from 4 to 12½ cents per pound. Jordan considers it "one of the most important species in the San Francisco market." It is sold in the markets under the trade names of "sturgeon," "bass," "white salmon," and "tenderloin sole." The latter is the choice piece. The trade names generally apply to the particular part of the fish the "cut" is taken from, and the manner in which it is carved. A lengthwise cut has a different trade name and a different price from a piece that is cut crosswise. The ordinary weight of this species is from 50 to 100 pounds; it often attains a weight of 300 to 500 pounds, and one taken in 1876 is said to have reached 800 pounds.

The green sturgeon (*A. medirostris*) is not in favor as a food-fish. Ten years ago, according to Jordan, it was not used for food, and had the reputation of being poisonous. Now it is found in the markets only when the white sturgeon is scarce. Both varieties are reported less plentiful than formerly.

Skates (*Raia inornata* and *R. binoculata*) are abundant and in good demand in the markets. The small ones sell at from 10 to 25 cents each, and the large fish at from 2 to 6 cents per pound.

Shark's fins are sold in the market, but no special attempt is made to get them. The very few brought in are taken incidentally. The price is 10 to 25 cents each.

Dogfish (*Squalus acanthias*) are numerous; they are sold to the Chinese.

Squid (*Ommastrephes tryoni* Gabb) and octopus (*Octopus punctatus* Gabb) are largely eaten by the Chinese, and are chiefly a product of the Chinese fishery. Squid come mostly from Monterey, and are mentioned here principally for the purpose of calling attention to the market supplies; the price is from 5 to 10 cents per pound. Octopus retail at from $1.50 to $2 each; if cut up, each of the arms sells for 25 cents.

Oysters have been discussed in a special chapter.

Clams (*Mya arenaria* and *Tapes* [*Cuneus*] *staminea* Conrad) are found in the markets at all seasons. The soft clam, or *Mya*, is very abundant in San Francisco Bay, but the round clam is obtained from the northern coasts, and in limited numbers. It is believed by competent authority that *M. arenaria* has been introduced, incidentally, with oysters brought from the Atlantic coast. Dr. R. E. C. Stearns, adjunct curator of mollusks in the U. S. National Museum, has ably discussed this question in a paper entitled "*Mya arenaria* in San Francisco Bay," which appeared in the American Naturalist, May, 1881. He says:

> Since 1874, the date of the description [by Dr. W. Newcomb, who named it *M. hemphillii*], the *Mya* has become abundant, and is found for miles alongside the easterly shore of the bay, and is now the leading clam in the markets of San Francisco and Oakland, superseding to a great extent the previous "clams," *Macoma nasuta* and *Tapes* (or more properly, *Cuneus*) *staminea* Conrad, in its varieties, especially *diversa* Sby., and the now dominant clam of the fish stalls is found exhibiting all of the characteristics of *Mya arenaria*, and is universally conceded to be the same as the Atlantic species.

Mussels (*Modiola capax*) are plentiful. They sell for 4 cents per pound. The large common crab of the Pacific coast (*Cancer magister*) occurs in greatest numbers outside of the Golden Gate. It is an important source of food supply. It can be taken at all seasons and sells at from 5 to 10 cents. It sometimes attains a weight of 4 pounds. Shrimp are extensively sold in the market; they are discussed at length in the chapter on the shrimp fishery. Prawns (*Pandalus danæ*) are obtained in moderate supply; the price varies from 15 to 20 cents per pound.

Frogs are taken in the vicinity of San Francisco; they also come from San Mateo, Marin, and Kern Counties. The average market price is $3 per dozen, but it is sometimes as high as $5.

Terrapins are obtained from the swamps, ponds, and lakes of this region, but chiefly from the San Joaquin Valley. They average about 2 pounds each and sell at $3 per dozen.

Sea turtles are kept in the market but are not taken here. They come from the Mexican coast; their average weight is 80 pounds; the market price is $3.50 each.

Destruction of fish by sea lions.—Much has been said and written about the destruction of fish in San Francisco Bay and vicinity by sea lions and seals, of which there are large numbers about the entrance of the Golden Gate and at the Farallones. They are commonly seen in the bay and even enter the rivers. Opinion is divided, however, as to whether the scarcity of fish is due to the seals or to the capture of quantities of immature fish by the Chinese. This is an interesting subject, and considerable information has been gathered bearing on both sides of the question; but in the present undetermined status of the case it is only necessary to call attention to the scarcity of market fish on some of the grounds and the alleged causes therefor.

Fishing grounds, seasons, etc.—Herring, smelt, salmon, shad, flounders, perch, and sturgeon are the most important varieties and constitute the bulk of the catch of the market fishermen in San Francisco, San Pablo, and Suisun Bays. These species are taken chiefly with sweep nets or paranzellas, stationary and drift gill nets, which are operated wherever fish may be temporarily most abundant. The first run of herring, about the last of October or early in November, generally strikes into

Richardson's Bay as the fish are passing through the Golden Gate, but they often go across to the east side of San Francisco Bay at the same time. About October 20 gill nets are set in Richardson's Bay and upon the shallows on the east side of San Francisco Bay, from Union City Creek to Alameda Pier, and off Point Richmond. Fishing continues in these localities until about the middle of March, but the fish change their positions frequently, being influenced by wind and weather, and occasionally schools of herring enter the adjoining bays. The greater part of the catch is taken in Richardson's Bay, where from 35 to 40 boats engage in the fishery, which succeeds the smelt fishing.

The principal fishing grounds for smelt are in the southern part of San Francisco Bay. Smelt are taken with gill nets and seines in the shoal water of the east side of the bay, between Alameda Pier and Union City Creek, from November to February. A favorite fishing ground from January 15 to June 15 is in the channel from off Point San Bruno to Potero Point, at the head of the bay, and some are caught here even as late as August. Smelt are taken in April from Point San Bruno to Point San Mateo, and in May in the shallow water north of Oakland Pier as far as Brooks Island. Another locality resorted to in July and August is near the shore, a short distance south of the city, between Mission Rock and Point Avisadero.

During April and May fishing for salmon with drift gill nets begins on the ground from off Point Richmond to Oakland Pier; this is continued to July; the catch is small here during June and July. In May and June nets are set for salmon in the channel south of Oakland Pier, and a few fish are taken there. From April to September salmon are netted in San Pablo Bay, from Point San Pedro to Benicia, from Mare Island up Napa Creek, and on the north side of the bay, in the channel leading to Petaluma Creek, and on the shoals off Sonoma Creek. Salmon are taken throughout Suisun Bay in spring and fall.

Shad are caught incidentally in nets set for other species in San Francisco Bay and the adjacent bays, also in the Sacramento River.

Flounders are taken all over San Francisco and San Pablo Bays, chiefly where the water is shallow, so that the "sweep nets" or paranzellas can be most successfully operated. Specially favorable localities in San Pablo Bay, both for flounders and sturgeon, are the broad, flat reach (inside the 6-foot curve) on the north side of the bay (see map, plate VI), the bend west of Penole Point, and the deep, bay-like curve between the latter and Point San Pablo.

Sturgeon occur all over the bays and streams emptying into them, but are generally most numerous in the shallow reaches near shore.

Fifteen of the largest market boats engage in trawl-line fishing outside the Golden Gate at all seasons of the year whenever the weather will permit. A large number follow this fishery in summer. Between April and November trawls are set along the coast south of the Golden Gate as far as Pigeon Point, but the "south shore" is not frequented in winter. The "north shore," between Duxbury Point and Bodega Head, a distance of about 40 miles, is a favorite fishing ground at all seasons. The catch on trawl lines is made from ½ to 5 miles from the shores above mentioned, and also off Noonday Rock, and the North, Middle, and South Farallones. The catch consists chiefly of the numerous varieties of rock-cod and cultus-cod, with an occasional halibut and greater or less quantities of other species taken on hooks.

Fishermen, lay, etc.—The market fishermen of San Francisco, exclusive of the Chinese, are, with very few exceptions, from the south of Europe. Italians predominate, but Slavonians, Greeks, Portuguese, and Spaniards are numerous. They have brought from their native lands the peculiarities which distinguish fishermen of those countries; and one standing on the market wharf at San Francisco watching the arrival of the fishing feluccas, and noting the dress, manner, and language of the fishermen (for many speak their mother tongues), might easily imagine himself the witness of a fish-marketing scene on the Mediterranean coast. The men are hardy, are reputed to be brave and skillful, are industrious, and are willing to work for small returns if necessary. It has been said of them that—

> The fisherman's life is full of hardship and work. The dangers of the calling are manifold. They are hardy, temperate, and frugal. Their days are spent on the water and their families see but little of them. They are generous and kind to each other. They are keen in business matters, and do not allow themselves to be cheated by dealers on shore. Some of them have amassed a competency and retired from business. There are but few instances of poverty to be seen among them, and nearly all of them have a snug sum put by for emergencies. * * * They are seldom idle. After a trip has been made and the boat's load of fish sold, they may generally be found on their boats or the adjoining wharf, repairing or drying their nets and seines, making lines and adding hooks, or doing some kind of labor on their boats, preparatory to another fishing voyage. (San Francisco Chronicle, November 11, 1883.)

This rose-tinted picture of success and "competency" is undoubtedly overdrawn. It is true that some have been moderately successful, and, by close economy, have become boat-owners or dealers on shore. But the majority have not been so "lucky," and, though there may be little actual destitution, the earnings are no larger than those of the New England fishermen who follow their trade throughout the year. There has, however, been a marked improvement in this respect in the past ten years. A decade ago Jordan found "the wages earned by the bay fishermen in San Francisco pitifully small, very few of them earning more than the $3 per week, necessary to pay their board bill." Earnings vary greatly in different seasons, but in 1889 it was stated that the "high line" of the fleet shared $700, while the smallest share was estimated to have been $300. The average wages was placed at $400 by competent authority. Naturally they are clannish and opposed to having others secure anything like a controlling influence in the trade. If occasion calls for it, they have the reputation of standing by each other to the bitter end, and this spirit of trade union has, no doubt, been a most important factor in maintaining their unquestioned supremacy in the market fishery.

They have several societies, among which the California Fishermen's Union, on Vallejo street, is perhaps the most important.* Here they meet to discuss and act upon all matters relating to their calling and which may affect their welfare, special attention being given to State laws regulating the fisheries.

The lay upon which the fishermen work is as follows. The owners of a boat furnish all fishing gear—lines, nets, etc.—and receive one share. In settling, the cost of all provisions and outfit, other than fishing gear, is deducted from the gross stock, and the remainder is divided equally, the boat counting as one man in the division and getting one share, while an equal amount goes to the captain and each member of the crew. Some fishermen own their boats, but in many cases the little vessels belong to the marketmen.

The fishermen find constant employment in pursuit of the many kinds of fish that frequent these waters. Certain species are always arriving to take the places of those departing. This necessitates changes in gear and continuous activity.

The financial success of the San Francisco fishermen is often seriously affected by the great quantities of fish received from stations on the coast, making the price unremunerative. Then the local market fisherman gets but little for his labor, and he complains most bitterly.

Boats.—The majority of the market boats of San Francisco and vicinity are feluccas, but some are cat-rigged. Wilcox gives the number regularly marketing their catch at the city (exclusive of Chinese craft) as 126, which he classifies as follows: 8 boats from 32 to 36 feet in length, 51 from 20 to 25 feet, 20 from 18 to 20 feet, and 47 from 15 to 18 feet long.

An act of the California legislature, approved March 21, 1887, requires all fishing boats to obtain a license. In many cases, however, especially in thinly settled coast sections, the law has not been thoroughly enforced, and the records of boats licensed generally gives an inadequate idea of the actual number employed. In the region including San Francisco Bay and the Sacramento and San Joaquin Rivers, 452 boats, all told, were reported as licensed. These are divided into five classes, the classification being based on the number of men working on a boat. Class A includes boats with less than three men, and each boat of this class pays $5 license fee. Those with three men come under class B, and pay $7.50. Then follow the classes C, D, and E, $2.50 extra being charged for each man carried in a boat in addition to

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*A writer in the San Francisco Chronicle, of November 11, 1883, says: "The fishermen are nearly all members of the Fishermen's Protective and Benevolent Association, which has had an organization here since 1877, with a large membership. * * * The office of the association is located at 23 Vallejo street."

FISHING FELUCCA.

three. Thus, a crew of four pays $10, five men are taxed $12.50, and so on.*

The market fisherman paints and repairs his own boat, makes new sails, repairs old ones, and attends to the fitting of rigging. The boats are built at San Francisco by Italians and Greeks, who also turn out small craft of this type for use elsewhere along the coast. There are three boat-building shops (with an average value, with accessories, etc., of about $1,000) that employ two or three men each.

Apparatus and methods of fishing.—The frequent changes in fishing caused by the appearance or departure of certain species compel the market fishermen to use a great variety of apparatus to secure the best results. It is common for a boat to be fully equipped with hand and trawl lines, salmon gill nets, herring or smelt nets, seines, etc.; but most of this gear is generally stored on shore, the boat carrying only that required for the special fishery it is employed in at the time. Many small boats engage in crab fishing throughout the year and require no change of gear.†

The crews of the boats vary from 2 to 6 men, the number depending upon the size of the craft and the fishery it is following.

The larger class of boats generally pursue the flounder, rock-cod, smelt, herring, salmon, etc., in their respective seasons, and employ all varieties of gear known to the trade. The hand line is perhaps the most common form of apparatus. Whatever other gear may be put into storage, eight hand lines are generally kept on each boat, as they occupy little space and can often be utilized to good effect, when otherwise the time might be lost, as when a boat is becalmed. Occasionally the trawl lines do not find good fishing, owing to the poor quality of the bait, which may have been on the hooks longer than usual, or to various other causes known to fishermen; and at such times the hand lines play an important part in securing a fare. Sometimes two-thirds of the day's catch will be taken on hand lines. There are three sizes of lines. The smallest is about 20 fathoms long, with a sinker weighing one-half pound. A medium size is twice as long and with double the weight of sinker; the longest used is 75 fathoms, with a lead weighing 2 pounds. They cost, respectively, 35 cents, 60 cents, and $1.

From 30 to 40 baskets of trawl lines are carried by each boat when trawling. Each basket holds a little over 100 fathoms of ground line, with from 150 to 180 hooks attached. The gangings are 3 feet long and 3½ feet apart. The cost per 1,000 hooks, including buoy lines, etc., required for setting them, is $27. The trawl baskets are oval in form, made of wicker work, and are similar to those used by the Irish market fishermen sailing from Boston. They cost 50 cents each.

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* This tax is considerable in the aggregate, reaching the sum of $3,010 for licenses issued for Humboldt, Tehama, and Shasta Counties, and the region previously mentioned, viz: Class A, $2,425; class B, $52.50; class C, $170; class D, $337.50; class E, $25.

† Alexander remarks that "on an average 100 boats follow crab fishing the year round; the smallest boats, as a rule, are used in this fishery."

The method of fishing with trawls is similar to that on the Atlantic coast, when sailboats are employed. The lines are first baited and coiled in the baskets ready for setting. When the fishing ground is reached the buoys, anchors, and buoy lines,* are bent to the ground lines, and when all is ready the boat stands along under easy sail (or is rowed if there is no wind) while the first buoy is thrown over, followed by the buoy line, after which the trawl is paid out. If the ends of the sections in the baskets have not previously been tied together they are quickly bent at the proper time; and this goes on until all the hooks are out, when the last end of the ground line is followed by the anchor, buoy line, and buoy. Five to 35 baskets of trawl are set at one time, the quantity varying with conditions of weather, etc. The gear is hauled in the ordinary manner and the fish are generally stowed in tiers in the hold, where they are arranged heads up, and lie that way until the boat reaches the market dock.

The herring gill nets used in San Francisco Bay are 30 fathoms long. Seven to ten of these are set in a string. Each boat usually has ten nets, but all of them may not be set at the same time. Smelt nets are often set for herring, according to Alexander. These are 40 fathoms long, 10 to 12 feet deep, with mesh varying from 2 to 2¼ inches. They cost $25 each. As a rule, 5 smelt nets are set in a string.

Salmon gill nets vary in size with the locality, those used in the bays and the Lower Sacramento being larger than the up-river gear. The former range in length from 40 to 50 fathoms, are 40 to 45 meshes deep; mesh, 8¼ to 8¾ inches. Several are fastened together for drifting, making essentially one net of 250 to 500 fathoms in length, worth from $200 to $400. Each boat usually has ten nets, with an average value of $30 each. The method of operating these is the same as on the Sacramento River.

The sea-bass gill nets are 20 fathoms long, 8½-inch mesh, and 40 meshes deep. They are made by the fishermen. The bulk of the twine of which they are knit comes from Boston, Mass.; some is imported from Europe; the former costs 60 cents per pound and the latter 85 cents.

The barracuda gill nets are essentially the same as used elsewhere, and are operated in a similar manner.

The trammel nets, locally called "drift nets," or "3-mesh nets," are usually 50 fathoms long and 10 to 11 feet deep. The large mesh varies from 17 to 18 inches and the small mesh from 5½ to 6 inches. They cost $30 each. The web for the central net is machine-made, but the rest of the net is made by the fishermen.

The paranzella is the form of net ordinarily used for catching flounders and such other species as can be taken in this apparatus. By

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* Stones are very often used for anchors, and tin cans are in favor for buoys.

Americans, who are unfamiliar with its European origin and name, it is called "flounder net," "drag net," "drag seine," "bag seine," "deep-water drag seine," etc., the name in each case having an allusion to some peculiarity of form, operation, or species taken in it. The size commonly used for flounder fishing in San Francisco Bay and contiguous waters has a conical bag in the middle (at the bunt), 18 feet deep and 5 feet wide across its mouth. The wings are each about 150 feet long, 15 feet deep where they adjoin the bag, and taper to 12 feet in depth at the extreme ends. The mesh at the wing ends is from 2½ to 3 inches, but grows smaller towards the bunt, where it is only 1 inch, while the bag has a ½-inch mesh; the cost is $125. These nets are often, if not generally, operated like a drag seine, being hauled over the bottom by men standing on the shore or in shallow water near the shore.

Alexander states that "drag nets that are hauled on shore are from 300 to 420 feet long, 18 to 24 feet deep, bag 18 feet long, mesh of wings 4½ inches, of bag 2½ inches." Those used in deep water have a bag 30 or 40 feet deep. This extra length prevents the escape of fish. When the paranzella is operated by boats the method is essentially the same as at Santa Cruz. Fishing with this is perhaps most common in the bays where the water is shallow.

The steam tug *U. S. Grant* operates a paranzella on sandy patches in deep water off Point Reyes and the Farallones. Her catch is chiefly flatfish, but other species are also sometimes taken. She carries a crew of seven men all told, namely, captain, engineer, one fireman, four fishermen or deck hands.* The following account of a trip on the *Grant* is extracted from the San Francisco Call of April 4, 1887:

> Near the stern of the boat * * * two booms, 45 feet in length, project over the sides and water, which contain ropes attached to the mouth of the net. The nets are 100 feet long by 40 feet wide, and there are always two of them aboard. The fishing is done by trolling. When the vessel arrives at the fishing ground she moves along very slowly with the net trailing at the bottom of the ocean. The nets to the fish appear stationary, and the piscatorial idiots swim through the mouth and are thus easily caught. No bait is used. Heavy sinkers are employed to hold the net down to the bottom. Off Point Reyes, the usual fishing ground of the vessel, the bottom is at 40 fathoms. The Call reporter, who was courteously permitted to enjoy a trip on the steamer, arose at 3 o'clock last Friday morning, and at 4 o'clock found himself at Green street wharf, off which the *U. S. Grant* lay. * * *
>
> It was yet far from dawn when the little vessel cast off her moorings at the wharf and picked her way carefully through the shipping out into the stream. The morning was a mild and pleasant one, and the stars overhead afforded sufficient light to steer by. Once out into the stream the little steamer puffed away and made rapid progress toward the Heads. The jutting hills on either shore and in the water looked black and ominous, but the electric and other lights blazing everywhere relieved the prospect considerably. A fresh and invigorating breeze was blowing in from the ocean, but it was too cold for comfort. Soon the vessel began to roll; * * * she had passed through the Golden Gate, and before the sun had risen very high she was off Point Bolinas. By half past 7 she had arrived off Point Reyes, the fishing ground.

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* The captain receives $100 per month, the engineer $100, the fireman $60, and the fishermen $40 each.

a distance of about 35 miles from this city. The morning was cool, but clear and sunny. The engine was stopped, and the net was got ready for business. The meshes were soon in the water, and being lowered by the ropes to the bottom. The net was suffered to remain at the bottom until about 11 o'clock a. m., and during that time the craft gently moved along, bobbing up and down on the swell. * * * A moment or two before the performance of hauling in the net was begun not a bird was visible anywhere, but as soon as the fishermen commenced to haul in the almost interminable length of rope, to the accompaniment of their "yo-heave-hos," the very air became alive with sea fowl.

Professor Jordan gives the following account of the history of paranzella fishing at San Francisco, and its effect upon the abundance of fish in the bay:

Previous to 1876 fishermen working with seines for the San Francisco market made very good wages, occasionally running as high as $25 per night for each seine. In 1876 some of the fishermen secretly ordered a drag net to be made, and took it out for trial without the other fishermen knowing it. The experiment was entirely successful, and the drag nets have been used in San Francisco since. Their introduction naturally created quite a stir among the other fishermen, especially among those who had previously supplied the market with tomcod and flounders. Threats were made to burn both drag nets and the large boats which were used to pull them, and for several months it was necessary to keep watch over the "paranzellas." There is still a great deal of opposition to the use of these nets, fishermen complaining that by means of them so many young fishes, especially flounders, are destroyed that the fishing around San Francisco is thereby greatly injured. Fishermen tell me that they are in very general use along the shores of the Mediterranean. San Francisco is probably the only place where they have been introduced into this country.

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As soon as the "paranzellas" were introduced a large reduction took place in the price of such fish as they caught. Before their introduction tomcod sold, wholesale, for from 25 cents to 40 cents per pound, and they never reached a lower price than 8 cents per pound in the summer. *Parophrys vetulus* sometimes in the winter brought as high as 50 cents per pound, and in summer sold for from 10 cents to 15 cents per pound. Wholesale prices now never range higher in winter than 20 or 25 cents for *Parophrys*, and 8 or 10 cents for tomcod, and in summer 4 cents per pound for the former, and 3, 4, or 5 cents for the latter. Of course, part of this is due to the same causes that have lowered the prices of all articles, but the greater part of the reduction was caused by the drag nets. They have thus far been rather a blessing than otherwise to the people of San Francisco.

Each boat engaged in crab fishing has 12 nets, costing from $2.50 to $3 apiece.

Preservation of apparatus.—All the gill nets, trammel nets, paranzellas, net ropes, trawl lines, etc., are tanned. Tar is not used to preserve fishing gear. The business of tanning the apparatus is monopolized by one person, who has three large iron kettles in a dilapidated building; the latter (with accessories) is valued at $600. Each kettle has about 400 gallons capacity, and frequently all these are used for boiling the tan liquid in which the gear is immersed.

Bait.—Herring, smelt, sardines, and anchovies are chiefly used for bait by the market fishermen. When herring are abundant and cheap considerable quantities are salted in brine. Part of these are sold for food and the remainder kept for bait.* The smelt is prepared for bait by cutting off its head, removing the viscera (including the dark peritoneum), scaling it, and taking out the backbone. This process leaves the two boneless sides of the fish, or slivers, which alone are considered suitable for bait. Fresh bait is preferred, and, when it can be had, from 500 to 1,000 pounds are taken on each trip.

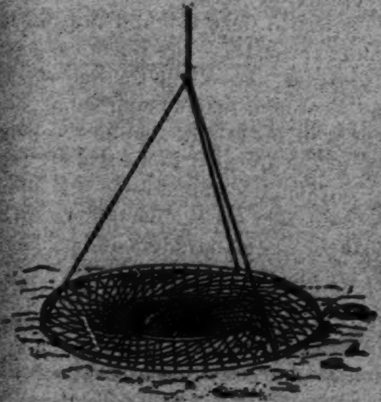

FIG. 1. Crab net set on bottom.

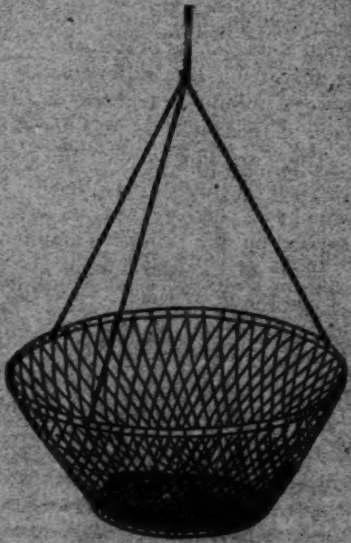

FIG. 2. Crab net drawn up.

Dr. Bean says that salmon roes are used for bait, and it is common to see a sign in the market as follows: "Salmon eggs for bait."

There is no complaint of scarcity of bait. Clams and squid are not in favor for this purpose. The fishermen think they are much less attractive lures than the species commonly used, and since they generally sell at remunerative prices there has been little reason for experimenting with them.

Marketing the products.—It may first be said that the wholesale fresh-fish business of San Francisco is practically controlled by a few firms, or dealers, who handle the best of the products and cater to the highest class of trade. In addition to their wholesale business, which embraces the shipment of quantities of iced fresh fish to interior cities and towns, a retail trade is carried on from the stalls in the following markets: California market, Clay Street market,* New Clay Street market, Grand Western market, Central market, Bay City market, Center market, and Mission market.†

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* The cod fleet take a few barrels of salt bait to begin with or to tide over any scarcity, but they usually depend upon getting their bait on the fishing ground.

These are important markets, in which a large general assortment of provisions is sold. The fish stalls are generally provided with marble counters, and ordinarily present a neat and attractive appearance, while there are usually on sale many species to select from. While the list includes numerous kinds of fish, etc., the supply exposed for sale is not large, and considerable care is taken to keep the stock in as good condition as practicable in the refrigerators, with which each stall is provided. But, unfortunately, care and neatness are apparently not always prominent features of the San Francisco fresh-fish trade. The lack of these will be considered more fully farther on.

There are 15 wholesale and retail dealers in fresh fish and 25 engaged exclusively in the retail trade. Besides these, there are street venders, who hawk their wares from house to house. As a rule the business is carried on in a primitive manner, no records or books being kept.

Some of the marketmen are owners of boats and handle the bulk of fish taken by them; nevertheless, prices are said to be usually fair and satisfactory to the fishermen. Although combinations are often formed by the dealers to control the trade, they are seldom of long duration. In addition to the wholesale dealers, the small traders and peddlers (Italians, Portuguese, and Chinese) are among the purchasers.

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* In 1880 Dr. Bean found that the rent paid for small stalls in Clay Street market was from $50 to $60 per month.

† A writer in the San Francisco Call (March 31, 1887) makes the following remarks concerning the so-called Wharf market:

"It is a rectangular shed, about 125 feet long by 50 wide. Mr. Scotto rents stalls to fishermen at 2 bits per man per week. All around the inner wall of the shed run fish-stands, with a passageway behind them. When the market is in full blast these stands are piled up with fish, sometimes in boxes, sometimes lying loose. On stands where there are no fish, nets are heaped; when daylight comes the fishermen will unroll these and mend them. In the middle of the building are more boxes and stands covered with soft-shelled crabs and fish. Around these, and lounging at the stands by the wall, are the fishermen and their customers, the Chinese predominating among the latter."

The description given above applies to the building at the head of the dock and the conditions which prevailed at the time the article was written. It is proper to say, however, that those conditions have materially changed. On the many occasions when Mr. Wilcox visited the market wharf and entered the building no fish were exposed for sale, nor were there any indications that the structure had been used for a fish market for many months. The stands were invariably piled with nets. At present it is customary for fishermen to sell their products directly from the boats and deliver them on the wharf to the purchasers. The buyers usually go on board of the boats to inspect the cargo and inquire the price asked by the fishermen. If terms are satisfactory a bargain is arranged and the fish are landed on the wharf.

The boats that go up and down the coast, or off to the fishing grounds, around the Farallones, some 35 to 40 miles distant, are generally absent from 2 to 4 days; but those that fish in the bays make shorter trips, usually marketing the catch of one day on the following morning. As soon as the fishing is over, the huge lateen sail is hoisted, the boat is headed homeward, and if there is a good breeze all the canvas that she will stagger under is kept upon her; or, if it is calm or the wind light, the swarthy crew toil away incessantly at the oars hour after hour until it seems they must fall down from utter weariness. No effort is spared to reach the market at the earliest moment, for any delay will result in the deterioration of the fish or loss of opportunity for selling them. No ice is used, and fish taken on distant grounds are too often not in good condition when they arrive. The start for market is commonly so timed that the boat may arrive about midnight, or early in the morning. Most boats reach their docks between midnight and sunrise, but generally a few belated ones come straggling in during the day.

It is an interesting and unique experience to stand on the pier in the midnight hours and watch the arrival of the market boats. Nothing disturbs the stillness except the ripple of the miniature waves caused by the brisk breeze and the lapping of the water upon the piling of the piers. Even the snort and puff of the steam tug, which is always so persistently nosing around in all corners of the harbor looking for a job, is no longer heard, and only the shadowy figures of "fish-hawkers," moving about near the head of the dock on the lookout for arriving boats and bargains in fish, give indications of life and wakefulness. Suddenly, in the hazy indistinctness of the night, we note, in the shadows cast by the hills that border the Golden Gate, a swiftly approaching object, dimly outlined and resembling the wing of a giant sea bird sweeping in from the ocean. Soon it looms into plainer view, and beneath the great breadths of canvas that stand out hard and unyielding in the stiff breeze, we see the dark hull of a fishing felucca, buried to her gunwale on the lee side, and rushing swiftly along through the water. How proudly she sails! Not a halyard or sheet is touched; not a move on board indicates preparation for shortening sail. We wonder what will happen as she comes tearing along for the pier-head; and now she is so close that disaster seems inevitable. But at this instant the hoarse-toned orders of the skipper ring out in quick succession and startling distinctness on the quiet night. Men run swiftly about the boat's deck; we hear the sharp rattle of sheaves, the rush of cordage; her long yard descends quickly to the deck, the lateen sail falls in graceful folds, while the jib disappears as if by magic; the dexterous hand of the helmsman moves the tiller at the right moment, and on comes the boat, sweeping gracefully into the narrow entrance to the dock, and a moment later she lies quietly alongside the pier, where her crew has placed her in a berth to land her cargo.

But others follow; and as we again look out upon the waters, boats may be seen approaching from up the bay, or from the sea, all leaning to the breeze under a cloud of canvas, their long, tapering yards and the lofty peaks of the lateen sails bending to the strain. And so they come, till the rising sun appears above the eastern hills across the bay, by which time most of the fleet lie snugly moored in dock.[*]

The wharf sale usually begins about 2 or 3 o'clock in the morning, but on Friday it commences as early as 1 o'clock. In each case it continues until the fare of the last boat is sold, unless the glut of fish is so great that the entire catch can not be disposed of. Generally, however, most of the fish are sold early, and at daybreak loaded fish vans are on their way to the large markets or shipping houses, or have already arrived there; the cry of "fresh fish! fresh fish!" may be heard from many pedestrian street hawkers, while the unmusical "toot, toot" of fish-horns announces the presence of fish-peddlers' wagons in the distant sections of the city and suburbs. Down in Chinatown "moon-eyed" fish-venders hawk their wares about through streets and alleys and shout their peculiar cries in their native tongue.[†] These generally have a yoke across their shoulders, from each end of which depends a basket containing the fish. Soon the retail markets are open, and few buyers are abroad before they can be accommodated.[‡]

But while the daily arrivals of fish are generally promptly disposed of, it nevertheless often happens that large catches may temporarily glut the market and render it difficult to sell at any price. As a rule, the fishermen quickly dispose of their products to the dealers or hucksters. The sale of herring and some other of the more abundant species is, however, often left to agents who sell on the wharf. When the market is overstocked by the arrival of thirty or more cargoes of fresh herring, the fishermen have a coöperative arrangement for regulating the sale, so that all may fare alike and no more fish be offered than can be disposed of.[§] The crew of each boat fills a box holding 80 pounds of fish, which is placed in the hands of the agent, who, when he has sold the first installment, has the boxes refilled. This stops competition and obviates much loss that otherwise would result to the fishermen.*

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[*] Each boat, when engaged in fishing, pays a stated sum for dock fees, assessments being made weekly when the boats are at work. The rates vary in proportion to the number of men, as follows: Boats with 5 men, $1.25 a week; with 3 men, 75 cents; with 2 men, 50 cents; and with 1 man, 25 cents. The boats, however, can remain in dock without charge when not engaged in fishing. This is nearly the same as a classification by size of the boat, and Alexander states it that way, saying that "a 31-foot boat pays $1.25 per week; the next in size (23 feet) $1, and one 18 feet long, 75 cents." This entitles them to all the privileges of the wharves and buildings.

[†] Dr. Bean says the Chinese are good customers of the market fishermen, since they pay extra prices for choice fish. The red-tailed perch is a special favorite with them and they often pay three times as much for it as for other species.

[‡] Alexander estimates that 250 men are employed in marketing fish in San Francisco, including the street peddlers and proprietors of small stands.

[§] A writer in the San Francisco Chronicle (already quoted) says: "Each boat has a representative in the market, and every Saturday night he divides the proceeds of the week's sales among his partners."

Care of the fish, etc.—In no other respect is change and improvement so imperatively demanded in connection with the market fishery as in the care of the products. The best interests of all are concerned in this; for improvement in this direction will materially benefit fishermen, dealers, and consumers. Complete success can only be attained by the utilization of all available resources and a proper appreciation of the needs and desires of the consumer. Obsolete European methods can not long meet with even passive favor in this country. San Francisco especially, with such an immense wealth of fish to draw upon† and fishing grounds at her very doors, should not only have a great variety of marine products for food, but should have those products placed before the consumer in the best possible condition. The consensus of statement, however, shows a very different condition of affairs in this respect from that which should exist. The most careful and conservative observers admit the necessity for change, while pages might be filled with quotations from newspapers relative to "bad fish" in the markets.‡ Published statements of this character are very injurious to the fishery, and it is to be regretted that they are in any manner justified. This matter should be seriously dealt with. The prosperity of the fishery depends in a large measure on the adoption of such methods as will tend to disarm criticism and to improve the demand for fresh fish, and at the same time relieve the fishermen from loss now frequently incurred through delay in reaching the market.

At present tight-bottomed boats are exclusively employed; the fish are not eviscerated but are thrown in bulk into the hold or left on deck with perhaps a piece of canvas spread over them to keep off the sun's rays. No ice is used, and in warm weather deterioration is rapid, all the more so because the viscera soon begin to ferment and decay. Under favorable conditions the fish caught in San Francisco Bay and adjoining bays reach the city in good order. But even here some of the grounds are 15 to 20 miles distant, and calms often delay arrivals for many hours. The boats that go out to the Farallones, to Bodega Head, or Drake's Bay, or down the coast toward Santa Cruz, are necessarily much longer in reaching the city even under the most favorable circumstances, while light winds or calms (which often prevail) may make it impossible for them to arrive there until their catch is in an advanced stage of deterioration. The result is that either an unwholesome article of food is put on the market, much to the ultimate injury of the fishery (by destroying confidence and decreasing the demand for fresh fish), or else the fishermen must throw their catch into the sea.

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*On some occasions, when the market is so overstocked with herring that sales can not be effected at paying prices, a portion at least of the surplus is sometimes disposed of for smoking, and afterwards packed in small boxes of 5 or 10 pounds each, similar to the smoked herring put up on the Atlantic coast.

†On October 1, 1880, Dr. Bean recognized 40 different species of fish in the Clay Street market. These were chiefly the rock-cods, salmonidæ, pleuronectidæ, sciænidæ, and viviparous perch.

‡There seems to have been an effort to control this matter by the authorities. Dr. Bean says an officer makes a daily inspection of the markets and condemns any fish he finds unfit for food. Cart loads are daily thrown away at the foot of Seventh street.

The next point for consideration is the method of handling fish after they have been landed. Although there has been some change in this respect in recent years, and some of the better class of markets are well conducted, there is, nevertheless, much room for improvement. Eminent authorities agree in saying that "the bulk of the catch exposed for sale is stale and often repulsive-looking." The small dealers and street hucksters usually buy the cheapest material, and a majority of them use little or no ice. I have learned of instances where the peddlers did not even have a covering of any kind for their fish. Under such circumstances it is not difficult to believe that the condition of a wagonload of fish might soon become exceedingly repulsive, even though they were fresh when landed. But their condition must be additionally disgusting if they had already become somewhat stale before the boats arrived. One who has had excellent opportunities for observing this phase of the business expressed his surprise that any person would purchase from a cart fish covered with dust, their skins parched by the sun, their eyes sunken, and with myriads of flies swarming over them; and it has been remarked that "the manner in which fish are handled, generally taken care of, and presented to the purchaser, does not impress one with the idea that cleanliness is one of the main objects of the business." If these statements are not exaggerated (and instances of this kind are not uncommon), it must be conceded that improvement can not be inaugurated too soon or maintained with too great care; I prefer to think such cases are exceptional.

It is not necessary to dwell upon this matter longer. It is enough to know that all experienced and unbiased observers concur in opinion and assertion. The important question then, is, How shall this evil be remedied? It is at least feasible to offer suggestions that may materially improve present conditions. First, boats that are engaged in line or paranzella fishing can, at small expense, be fitted with wells for bringing in their catch alive, or at least the bulk of it. The fish not immediately sold could be transferred to live-cars and left with agents to dispose of in the absence of the boats. No part of the catch would be lost, and, since the fish would be alive, the consumer would be sure of getting them in the best possible condition. This would inspire confidence and increase the demand enormously. The larger fish—rockfish, cultus-cod, etc.—that can not be brought in alive should always be eviscerated as soon as practicable after being caught. If this is done, and the fish are well washed, they will keep much longer and better, and will be good food. The smaller species, like smelts, herring, and flounders, would also be vastly improved by evisceration and washing, but this is, perhaps, less necessary. If customers would refuse to buy fish that have not been gutted, and, for that reason, can not be closely examined to ascertain their exact condition of freshness, it would do much to correct the present undesirable condition of affairs.

It has been claimed by fishermen and dealers that they can not sell eviscerated fish, because the buyers believe that only stale fish are dressed. This is purely an idea imported from southern Europe, and a brief time would suffice to disabuse people's minds of such impressions.

Small, swift steamers, adapted to fishing and towing boats in calm weather, could undoubtedly do good and profitable service. They might also act as carriers and bring to market daily and quickly the catch of fleets fishing at the Farallones, about Drake's Bay, and in the more distant parts of San Francisco, San Pablo, and Suisun Bays. Indeed, some of them might be fitted with wells for keeping fish alive. Ice should be carried and used on the boats if it is feasible. With the present facilities for manufacturing ice, it ought to be produced at a figure that would make it available to all, and the improvement in the fish would doubtless repay considerable expenditure in this direction. Probably the establishment of cooling houses or refrigerators, such as are in operation in the eastern cities and on the Great Lakes, would prove profitable and advance the present condition of the fish trade.

All fish markets should be kept in a neat and tidy manner. Ice should be liberally used. Fish carts should be constructed so that their contents can be covered, and at least a small amount of ice should be used on them. No one is so much benefited as the fishermen by any improvement of this nature; for whatever adds to the attractiveness of goods offered for sale invariably increases the demand and adds to the profit of the producer. At the same time the salesmen and general public are gainers.

The effect of improved methods upon the distribution of fresh fish to the interior is a matter for special consideration. It is stated that the railroads and the express companies of the Pacific coast have signified a desire to make liberal concessions to build up the trade, to the extent, at least, of offering to transport iced fish and charging only for the actual weight of fish carried (no charge being made for weight of ice and boxes), and returning all empty packages free of cost to the shippers. The transportation facilities are good, and San Francisco ought to supply an immense area with fresh fish of many kinds. Pacific salmon reach all the Eastern and Central States, and why should not other valuable species do nearly as well?

Effects of Chinese traps and sea lions.—The market fishermen complain of the trouble caused by the trap nets set in the bays by Chinese fishermen. These are generally set upon stakes which come to the surface of the water. Drift nets are often caught and torn upon these stakes, and in some cases the damage is considerable. Much annoyance and some loss are caused by the sea lions that gather in numbers on the "seal rocks" just outside of the Golden Gate, and which roam all over the bays and ascend the Sacramento River as far as Rio Vista. These active and voracious animals are very bold and seem to have learned the habits and methods of the fishermen. They will follow the boats and wait around them until the nets are set. As soon as fish are gilled they are immediately seized by the sea lions, which, in addition to robbing the fishermen, often damage the apparatus materially. It is common for these animals to seize a salmon when the nets are being hauled, and fight and struggle with the fisherman for its possession with such determination that the net is usually torn and the sea pirate secures his booty.

While the damage to nets is considerable and the daily consumption of fish by these pinnipeds is enormous, the fishermen believe that the sea lions exert even a more baneful influence by preventing schools of fish from entering the bays. Many persons have thought that they had a marked influence in causing the reported scarcity of fish in San Francisco Bay. Under these circumstances it goes without saying that, were it not for the State law that protects the seals, the fishermen would soon attack their rookeries and materially reduce their numbers or destroy them altogether. But, while seals and sea lions consume large quantities of fish, many old citizens assert that these animals are far less numerous than formerly, when fish were very abundant, and they maintain that there is some other cause for scarcity of fish if such exists. As late as 1874 there was a rookery at Mountain View River, St. Clair County, where at present seals are seldom seen, while they generally gather in large numbers at Redwood Creek and various other places in the bay.*

Extent of the San Francisco market trade.—Records are not generally kept and it is impossible to tell the exact amount of fresh-fish products sold in San Francisco by hucksters and marketmen, including quantities handled by wholesale dealers who ship to other cities and the trade generally. A careful estimate, however, based upon the experience of the most observant and conservative dealers and upon the records of transportation agencies, gives the figures in the following table:

Summary of the fresh-fish trade of San Francisco in 1888 and 1889.

Species.	1888.			1889.		
	Pounds.	Average price.	Retail value.	Pounds.	Average price.	Retail value.
Fish.						
Anchovies	200,000	$0.03	$6,000	120,000	$0.05	$6,000
Barracuda	125,000	.08	10,000	110,000	.10	11,000
Bonito	50,000	.04	2,000	60,000	.08	4,800
Carp	100,000	.07	7,000	60,000	.08	4,800
Codfish	10,000	.17	1,700	12,000	.10	1,200
Cultus-cod	167,500	.08	15,000	100,000	.08	8,000
Eels	1,000	.50	500	700	.30	210
Flounders	465,000	.09	41,470	300,000	.10	30,000

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* At the time of completing this report (1890) sardines are reported so abundant in San Francisco Bay that they literally obstruct the passage of boats through the water.

Summary of the fresh-fish trade of San Francisco in 1888 and 1889—Continued.

Species.	1888.			1889.		
	Pounds.	Average price.	Retail value.	Pounds.	Average price.	Retail value.
Fish.						
Herring	2,612,000	$0.05	$130,600	1,900,000	$0.05	$95,000
Kingfish	60,000	.06	3,600	50,000	.06	3,000
Mackerel	25,000	.10	2,500	30,000	.12½	3,750
Mackerel, horse	100,000	.06	6,000	125,000	.08	10,000
Mackerel, Spanish	100	1.50	150	100	1.50	150
Perch, fresh-water	432,000	.12½	54,000	425,000	.12½	53,125
Perch, salt-water	220,000	.08½	18,700	200,000	.09	18,000
Pike	20,000	.06	1,200	18,000	.07	1,260
Pompano	2,500	.80	2,000	2,500	1.00	2,500
Rockfish	800,000	.08	64,000	340,000	.10	34,000
Salmon	3,300,000	.06½	211,200	3,100,000	.06½	[illegible]
Sardines	40,000	.05	2,000	800,000	.04	32,000
Sea bass	350,000	.06	21,000	400,000	.06	24,000
Shad	75,000	.10	7,500			
Skates	40,000	.03	1,200	75,000	.05	3,750
Smelts	800,000	.08	64,000	800,000	.08	64,000
Striped bass*				1,000	1.00	1,000
Sturgeon	450,000	.06	27,000	495,000	.06	29,700
Suckers	175,000	.02½	4,375	150,000	.04	6,000
Tomcod	8,000	.12½	1,000	5,000	.15	750
Trout, lake	50,000	.20	10,000	40,000	.25	10,000
Trout, brook	2,000	.30	600	1,200	.30	360
Miscellaneous	29,000	.07	2,030	22,000	.06½	1,[illegible]
Total	10,848,100		728,125	9,722,800		[illegible]
Mollusks, crustaceans, etc.						
Oysters .... bushels	120,000	2.50	300,175	150,000	2.50	375,000
Clams, hard-shell .... sacks	1,500	3.00	4,500	1,200	3.00	3,600
Clams, soft-shell .... boxes	31,200	1.50	46,800	18,500	1.00	[illegible]
Mussels .... buckets	42,000	.50	21,000	35,000	.50	17,500
Crayfish .... pounds	25,500	.09	2,250	32,400	.07½	2,430
Crabs .... dozens	77,800	.98	76,244	77,000	[illegible]	[illegible]
Shrimp .... pounds	270,000	[illegible]	[illegible]	175,000	.08	14,000
Prawns .... do	25,000	.20	5,000	20,000	.20	4,000
Squid and octopus .... do	25,000	.08	2,000	15,000	.08	1,200
Terrapins .... dozens	1,000	2.00	2,000	1,200	2.00	2,400
Turtles .... pounds	26,000	.05	1,300	20,000	.05	1,000
Frogs .... dozens	4,000	3.00	12,000	4,500	3.00	13,500
Total			707,329			741,[illegible]
Grand total			1,435,454			1,437,[illegible]

*Striped bass have recently been taken in such quantities that the price has been reduced to 10 cents a pound.

FISHERIES OF TOMALES BAY.

The fisheries of Tomales Bay (including settlements in Marin and Sonoma Counties) may properly be included with the market fisheries of San Francisco, as the products go chiefly to that city.* This bay is a long narrow inlet nearly parallel with the seacoast, and extending southward about 17 miles from its mouth. It is bordered on each side by rather high hills, and is of nearly uniform width; its entrance is about 45 miles (by water) from the Golden Gate. Papermill Creek enters the head of the bay. This stream is quite celebrated for trout fishing in spring; a few salmon also run into it.

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*The fisheries at Sausalito, Marin County, are really a part of the market fishery already described, in all that relates to boats, apparatus, methods of capture, marketing the catch, etc. The Chinese fishery camps at San Quentin, Point San Pedro, etc., in the same county, are discussed in a special chapter. Fisheries on the "bay side" of Sonoma County are considered under appropriate headings. It is, therefore, not advisable to follow county lines in dealing with the fisheries of Tomales Bay and vicinity, since it would involve repetition or a lack of clearness.

The bay is noted as a fishing ground, and its upper part is so near Drake's Bay, another excellent locality for fishing, that boats and apparatus can readily be transported across the narrow neck of land dividing them. The fisheries of the region are vastly benefited by the railroad that skirts the eastern side of the bay, passes through the small settlements, and affords important facilities for the rapid transportation of the products to market. The southern terminus of the road is at Sausalito, on Richardson's Bay, where it connects with a ferry running to San Francisco.

Fishing centers, etc.—The principal fishing centers are Bodega, Freestone, Fisherman's, Marshall, Hamlet, Tomales, and Point Reyes; these are railroad stations on or near the shores of the bay and therefore convenient as shipping-points. Large quantities of fish are shipped to San Francisco (by express) from several of these stations. In 1888 83,440 pounds went from Fisherman's, 68,472 pounds of fish and 46,095 pounds of clams were sent from Marshall, while the shipments from Hamlet amounted to 95,945 pounds of fish. The species sought are practically the same as have been mentioned. Fish are abundant in Tomales Bay in their seasons, more particularly smelt, perch, herring, and sea bass; there are only a few salmon, and flounders are not numerous. The bulk of the catch is smelt and herring.

Clams of two species are abundant on the shores of the bay; one is the round hard-shelled *Tapes* and the other a large soft-shelled species; only the former is utilized. Oysters have been planted at the head of Tomales Bay; they did not thrive, and were ultimately taken up and the beds abandoned; oyster-shells occur in places in the bay, and some think natural beds may yet be found as a result of the planting referred to. Some years ago an attempt was made to carry on a frog farm, but the enterprise did not prove successful.

Sea lions and seals follow the schools of herring and smelt into the bay, and are plentiful and active, but are seldom or never seen at other times.

Boats and apparatus.—The fishing boats at Tomales Bay are generally from 17 to 20 feet long; they usually carry centerboards; some are sharp aft and others have square sterns. A sprit rig is generally used. One of these had the following dimensions: Length, over all, 20 feet; beam, 5 feet 10 inches; width of stern, 3 feet 8 inches; mast stepped 3 feet 8 inches abaft upper end of stem. They are not designed for service outside of the bay, and seldom go out into the ocean. If it is necessary to work in Drake's Bay, the boats are usually hauled across the narrow strip of land that separates the head of Tomales Bay from the seacoast. The only loss of life here in ten years was in 1887, when two fishermen were overtaken by a storm, which swamped their boat while attempting to reach Drake's Bay by the ocean. Drag seines and gill nets are the principal apparatus of capture.

Methods of fishing, shipping products, etc.—The methods of fishing are similar to those already described under the head of market fishing. The seines are operated from shore, and the gill nets are set in the ordinary manner, both as set and as drift nets. The bulk of the fish are shipped to wholesale dealers in San Francisco, who sell the products on commission to other dealers or hucksters, or ship them to the interior or to towns across the bay. For transportation, the fish are packed, heads up, in long wooden boxes about a foot deep with an average capacity of 125 pounds. Instead of using ice, wet sacks or gunny cloth are placed over each box to keep the fish moist. The nets are generally hauled early in the day and shipments made by the morning train, so that the fish reach the city a few hours after being caught.

Men, women, and children dig clams, but only the men (native Californians) engage regularly in this fishery. The average number of men employed in 1888 was 20. The clams are sold to the local dealers for $1.50 per sack of 70 pounds (4 wooden bucketfuls), the fishermen being paid in merchandise. The clams are emptied into bins built on the edge of the bay, and usually 75 to 100 bushels are kept on hand to supply orders from San Francisco.

The following tables show the extent of the fisheries of Tomales Bay in 1888; but these figures, as well as those for Russian River, are included in the general tables for San Francisco Bay and vicinity:

Persons employed.

Country.	Nativity.	Nationality.
United States	20	27
Austria	11	11
Portugal	2	1
Italy	22	16
Mexico	1	1
Total	56	56

Apparatus.

Designation	No.	Value.
Boats	21	[illegible]
Gill nets	210	[illegible]
Seines	10	2,000
Total		11,2[illegible]

Products and values.

Products.	Pounds.	Value.
Salmon, fresh	20,000	$1,000
Other fish, fresh	[illegible]	[illegible]
Clams	81,[illegible]	2,04[illegible]
Total	[illegible]	[illegible]

FISHERIES OF RUSSIAN RIVER, SONOMA COUNTY.

Russian River is about 100 miles in length and 75 to 150 yards wide over the principal part of its course. It empties into the Pacific 6 miles below Duncan's Mills. This settlement is a railroad station and shipping-point for fish other than those used locally. The only shipments of river-caught fish in 1888 were sent from this place.

Species, importance of fisheries, etc.—The river is well supplied with carp, pike, suckers, hardmouths (*Acrochilus alutaceus*), and sturgeon. Trout are numerous in the upper reaches and in some of the small tributaries that empty into the river near Duncan's Mills. In the spring of 1889 they were unusually plenty. During the fall and spring there is a run of "winter" salmon weighing from 8 to 20 pounds each. The principal fishing ground is the section of the river from its mouth to Duncan's Mills, about 6 to 8 miles.

This river is now rather unimportant as a commercial fishing center. At one time it was noted for the abundance of salmon in season; but injudicious and illegal fishing has materially reduced their numbers; and it is said that the decrease is generally apparent from year to year. In 1888, however, salmon were more plentiful than for several years, and the fishery for them was temporarily increased in importance. The river fishery derives its chief importance from the quantities of fish locally utilized, which amount to nearly five times as much as those shipped to market by express. In 1888 the local consumption of fish was estimated at 150,000 pounds, while only 33,507 pounds were shipped to San Francisco.

Fishermen.—There are only 15 professional fishermen; 10 of these are Italians and 5 are Portuguese. Besides these there are many people living along the river who fish at odd times to supply their own tables, disposing of any surplus to their neighbors, or in some cases peddling part of the catch through the country. The quantity of fish taken this way is considerable, and often a man may obtain a year's supply in a short time. But the irregular character of these operations, the sparseness of the population, and other causes make it impracticable to do more than to present estimates of the products and values.

Catch, etc.—From 75,000 to 100,000 pounds of salmon are taken for local consumption by those living along the river. The professional fishermen take from 20,000 to upwards of 30,000 pounds of salmon annually, constituting the bulk of the shipments; they also catch from 75,000 to 150,000 pounds of other fish, which are mostly disposed of locally or peddled through the adjacent country.

Apparatus, etc.—Gill nets are the principal form of apparatus, and these, particularly those used for the capture of salmon, are often smaller in the mesh than the laws of California permit to be operated. They are set in the usual manner.

Illegal fishing.—It is claimed that for several years past there has been much illegal fishing, and many believe that this has caused the scarcity of fish, especially salmon. Sometimes arrests are made, and for a while this action generally has a marked effect. In 1888 the "fishermen were reaping a rich harvest with their fine-meshed nets." These were set continuously to such an extent that the fish had little chance to ascend the river. No regard was paid to the requirements of the law. Finally, when some 20,000 or 30,000 pounds of salmon had been caught, all of the fishermen were arrested (January, 1889) and fined from $50 to $100 each. For several months, at least, this action had a decided influence on the river fisheries; professional fishermen were scarce or less active than formerly, and nets were not seen on the river. Those familiar with the facts believe the bulk of fish sent to San Francisco in 1888 were taken illegally.

Shipments.—The amount of fish shipped to San Francisco by the Wells-Fargo Express during 1888 is given below in detail by months. This statement will show the periods when salmon are taken. No shipments were made in the months omitted from this list.

Months.	Pounds.
January	14,077
February	3,785
April	250
May	300
October	650
November	8,485
December	6,150
Total	33,597

The following statistics given here apply only to Russian River and do not include other fisheries of the county. The statistics of the settlements in this county bordering on Tomales Bay have been combined with those of towns in Marin County to show the extent of the industry on that bay.

Statistics.

Persons employed (nativity and nationality):	
Italians	10
Portuguese	5
Apparatus:	
23 boats	$2,300
110 gill nets (40,000 feet long)	3,000
Products and value:	
33,597 pounds of fish shipped	2,016
150,000 pounds of fish consumed locally	3,000

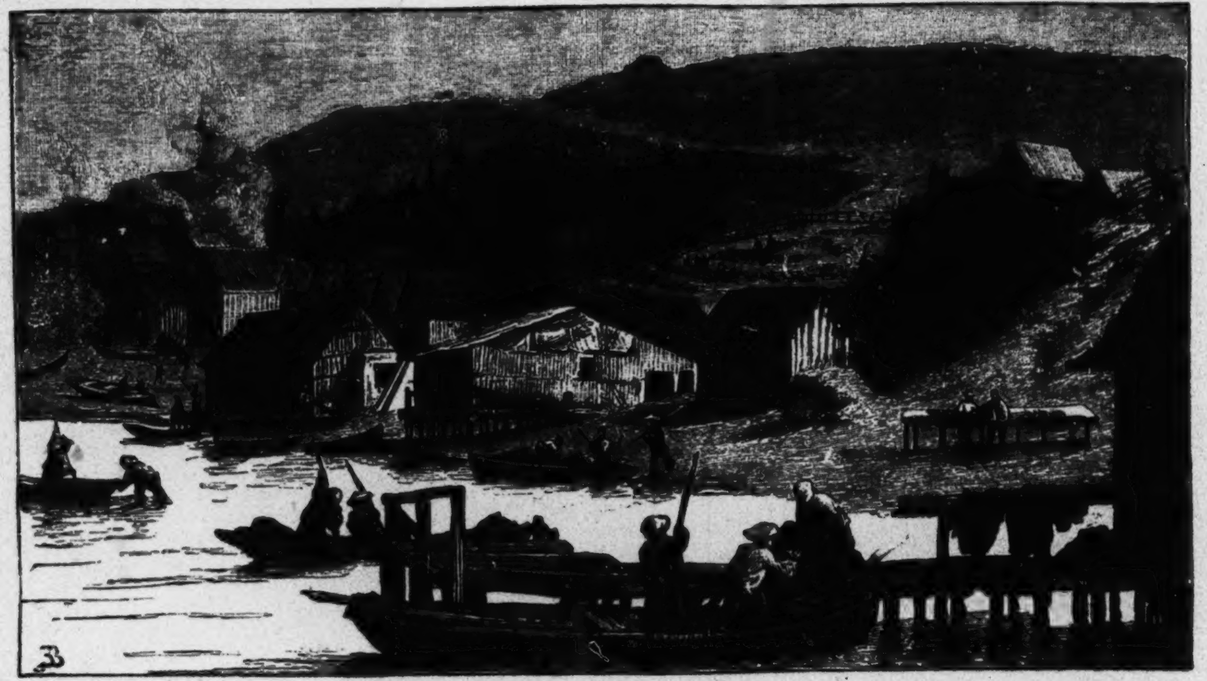
CHINESE FISHERIES.

Although the Chinese fishermen engage in the capture of a variety of species in San Francisco Bay, an effort will be made to present the facts in such a manner that the details relating to any special branch of the fisheries pursued by them will be clearly understood. The statistics given are estimates based upon the statements of those most familiar with these fisheries, including some of the Chinese, and upon a careful and intelligent consideration of the exportations of fishery products by this race, and the quantities disposed of for immediate consumption in the local markets, including San Francisco. While this is not entirely satisfactory, it is practically certain that the actual facts have been closely approximated.

For several reasons there was great difficulty in obtaining reliable statistics from the Chinese fishermen of this region. First, it was impracticable for either Wilcox or Alexander to visit the camps during the height of the fishing season; their visits were unavoidably made "between seasons," when comparatively little fishing is done, and when the camps are deserted by a large percentage of the fishermen, who seek employment elsewhere in winter. Second, the Chinese apparently have no idea of keeping accounts. Third, they are seemingly disinclined to discuss or to relate what they have done, evidently apprehending some purpose on the part of the investigator to get them into trouble. Feeling that they are opposed by all white men, and dreading ill treatment at the hands of the legal authorities or others, they are naturally suspicious and distrustful of the motive of inquiry, and are disposed to be reticent; this, together with the lack of familiarity with the language, the best of them being able to speak only a jargon of "pigeon English," renders it practically impossible to get intelligent and accurate statements from them. In many cases, however, much important information was obtained by a system of cross-questioning adroitly adapted to the circumstances.

So far as the size, character, etc., of the apparatus and boats are concerned, the data were obtained with great care and exactness; the measurements were made on the spot, and whenever practicable the boats, camps, etc., were photographed. Indeed, all possible sources of information were utilized, and it is therefore believed the data collected are as accurate as it is practicable to obtain unless one could live at the camps during the fishing season.

Fishing camps.—The Chinese fishermen do not affiliate with the market fishermen of San Francisco Bay, but form colonies or settlements of their own race, which are located near the fishing grounds. These "camps," as they are universally called, are composed of an aggregation of rude shanties and other needful accessories, such as drying-frames, etc., packed close together near the water. They are devoid of all suggestion of comfort or cleanliness and afford only the most meager quarters to these industrious people, most of whom find here only a temporary residence, and live in miserable squalor in their rickety and filthy huts. There are several of these camps on San Francisco Bay. These have incidentally been referred to under the head of "fishing centers." Four are located on the south side of the bay, at Hunter's Point (Point Avisadero on the map), Point San Bruno or



CHINESE CAMP, SAN FRANCISCO BAY.

"China Point," near Point San Mateo, and at the mouth of Redwood City Creek. At the north are the camps at Point San Quentin, Point San Pedro, and in San Pablo Bay, on the west side, and a mile or so south of Point San Pablo, on the east side of San Francisco Bay.

Species, etc.—Shrimp are caught in immense quantities by the Chinese, who have a practical monopoly of this fishery. Three species of shrimp are taken for food in San Francisco Bay, the *Crangon franciscorum*, *C. vulgaris*, and *Hippolyte brevirostris*. The former is the most important in the San Francisco markets, and excels in size all other species of shrimp on the Pacific coast of the United States. It is especially abundant in the region under discussion, particularly in San Francisco and Tomales Bays. *Crangon vulgaris* and *Hippolyte brevirostris* are much less numerous and not so large. They are taken with the other species, and constitute a small percentage of the catch.

Sturgeon and flounders are the principal fish taken by the Chinese, but nearly all kinds that frequent the waters of this region are caught by them. They capture great quantities of young fish, of which more extended mention will be made in a subsequent paragraph.

The soft-shell clams sold in the San Francisco markets are mostly taken by the Chinese.

Fishing grounds.—Practically the whole of San Francisco and San Pablo Bays constitutes the fishing grounds of the Chinese. The localities where they most commonly set their bag nets are shown on the map (plate VI); these are generally conveniently near their camps and where shrimp are known to be plentiful. Gill nets, seines, sturgeon trawls, fykes, etc., are also used, either to obtain the best results or to secure secrecy, since the Chinese commonly use illegal forms of apparatus.

Apparatus.—The apparatus varies in character, is exceedingly destructive of minute forms of marine life, particularly young fish, and is generally distinctively oriental; some is imported from China, but a large portion is made by the fishermen in winter.

Bag nets, gill nets, fyke nets, and sturgeon trawls are the principal forms employed. The bag net or "trap" is most in favor; it is extensively used in certain parts of San Francisco Bay and adjacent waters and is chiefly relied upon for the catch of shrimp.* This net is a great cone-shaped sack or bag, 42 feet long from mouth to apex, 24 feet wide at the mouth, and 4 feet wide at the bottom or point of the cone, which, when set, is tied up with a puckering-string or "sphincter," like the cod end of a beam trawl. When the net is hauled the string is unloosed and the contents of the bag are dropped into the boat. The bags are made of hemp twine. The half of a net next the mouth has a 2-inch mesh; the middle section, of about 10 or 12 feet, has a 1-inch mesh, while the lower or small end has a mesh measuring only one-half inch. Considering the contraction caused by tying up the small end of the bag, it will readily be seen that scarcely any marine life is minute enough to pass through the meshes. Wilcox saw one of these nets at San Quentin which had been imported from China, and it differed from the above only in width, it being 30 feet wide at the mouth and 18 inches wide at the small end. The mouth was oval or oblong in form, and when set would be about 6 feet deep. It had a row of floats or corks along the upper edge, and sinkers were fastened to the lower side of the mouth to keep it open. This net cost $12 in China, but the freight and import duty added materially to this amount.

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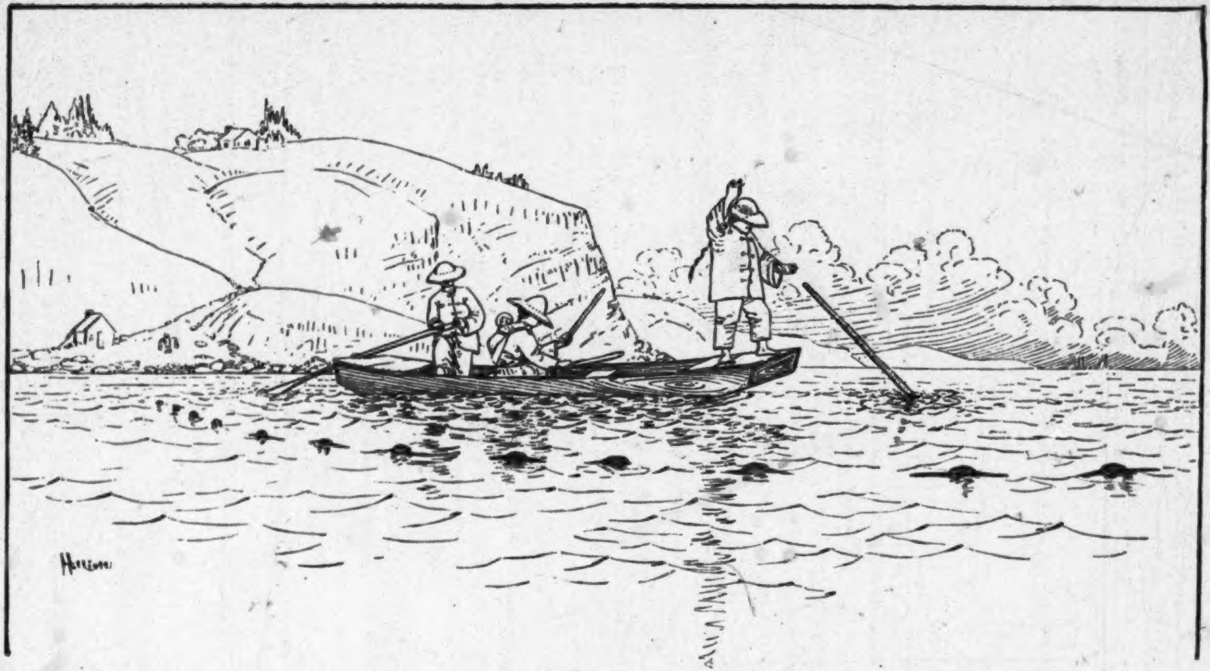
* This form of apparatus has been erroneously mentioned as a seine or "drag net" by some writers, though it is evident from the manner in which it is commonly operated that those names have been misapplied. I have failed to find any reliable information that it is ever used to haul shrimp on shore or that it is dragged over the bottom like the paranzella.

While some of these net bags are imported, the majority are made by the fishermen during the season when they can not do much fishing. In December, 1888, Wilcox visited the camp at Hunter's Point; only a half dozen Chinamen were there, all of whom were busy making hemp nets for their traps, to be used the following spring. The seines and gill nets are similar to those employed by Chinese fishermen elsewhere on the coast, and need not be described in detail. The fyke net is of the ordinary pattern. Alexander makes the following remarks concerning its use:

> The fyke net is by far the most destructive apparatus used for the capture of fish. This net has been described too many times to give it more than passing mention here. That they are used in every available place along the coast whenever circumstances will permit is a well-known fact. That they are the means of destroying prodigious quantities of small crustacea and other small fry, such as large fish of commercial importance subsist upon, is acknowledged by all; but no steps have yet been taken which have had the desired effect of wholly preventing this wholesale slaughter. The enormity of using fyke nets would be greatly lessened if there were any possible chance for minute species to make their escape after entering them; but the meshes are so small that the finest floating substance is captured. The various species of floating fish eggs which are annually destroyed in this way must be enormous. If on hauling or taking up these nets any pains were taken to liberate the eggs captured the destruction to natural propagation would be greatly alleviated; but on the contrary everything which comes to the net of a Chinaman is "fish," and is utilized for his gastronomic wants.

The sturgeon trawl has been used for a long time in China, and the natives of that country have introduced it in the fisheries of California, though its employment is illegal. Alexander says of it:

> This is a very cruel as well as a destructive way of catching fish. Each trawl has an average of eighty barbless hooks, which are as sharp as needles. They are fastened to the gangings in clusters of eight and ten, and when in the water are swung about by the action of the tide like the tentacles of an octopus reaching out for prey. A fish which approaches within a length of itself is pretty sure of being hooked by one or more of these treacherous devices. When a fish of any considerable size gets fastened to a hook it is sure in its struggle for freedom to become entangled with other hooks, and finally, in its floundering about, will become completely incased in a network of gangings and hooks, like a shark which has rolled



CHINESE GILL-NET FISHING. FRIGHTENING FISH INTO THE NET.

(Drawn by Henry W. Elliott.)

itself up in a net. There is no possible means of escape, and when thirty or forty sturgeons or other large fish are actively exerting themselves for liberty, and each struggle only tends to hold them more secure, the scene can better be imagined than described.

The wire of which the hooks are made is square, of the finest steel, and capable of holding fish of great size. The trawls are always set off bottom and from three to five fathoms below the surface, according to the depth of water and the way in which the fish sought are thought or known to be moving. Often large numbers will be set in one string, they being bent together in the same manner as cod and haddock trawls; they are also anchored and buoyed in the same way. Some sturgeon trawls have a small wooden float attached to each cluster of hooks; but I am informed that this is an Italian invention and is not used by the Chinese. The trawls used by the latter class of fishermen have the hooks fastened to short gangings which are attached to short bridles, these leading to the ground-line. The whole apparatus is indeed a complicated one, and in order to give a correct and comprehensive description in detail it should be seen set in the water, which, by the way, is something seldom witnessed.

Methods of fishing.—Generally speaking, the bag nets or traps are put into the water early in spring, and most of them are taken up in November, when the fishery practically ends, though a few nets are fished all the year. Wilcox states that when he visited the Chinese camps, in the last week of December, 1888, he sailed through San Francisco Bay in the steam-launch of the *Albatross* for a distance of fully 30 miles without seeing a single trap net in the water. The number used varies somewhat in different camps, but on the whole amounts to an average of five or six to a man. The nets are set in two ways. One method is to anchor them at the bottom, marking their positions by keg buoys floating at the surface. By the other method they are set in rows, the mouth of each fastened between poles driven into the bottom, with their upper ends projecting above the surface of the water. By this method the mouth of each net is fully distended, while the body of it swings away with the tide. All kinds of swimming animals that come in or go out with the tide are caught, for in some localities the bag nets completely cover the bottom across a wide area.

The nets are watched very carefully, and at each "slack" or turn of the tide they are taken up, the contents removed, and their direction changed, so that they will head the next set of the current and thus be prepared to take into their capacious pockets all that comes to them. The catch is secured, according to Wilcox, by taking up the mouth and tying up such part of the bag as can be easily handled; the contents are then emptied into the boat. Then another part is tied up and emptied, and so on, until the bag is cleaned of its contents, when it is once more set facing the return tide. Everything that enters these bag nets, large or small, is taken. The best fish are sold for food; the unsalable are fed to pigs or poultry. Shrimp are the most important part of the catch, both in quantity and value.

The gill nets are usually anchored, and are termed "set nets" when used in this way. The Chinese fishermen are very painstaking and lose no opportunity to secure a good catch. Having set their gill nets, they will stay near by in their boats and watch for approaching schools of fish; if they see fish close to the apparatus, and not disposed to enter, as is often the case, they will dart oars into the water or pound on the boat's gunwale to frighten the fish, so that they will, in their wild rush to escape, plunge into the meshes of the nets (see plate XIX).

Illegal fishing, destruction of small fish, etc.—It is generally agreed that the Chinese fishermen have little regard for the law (if they can evade it) and absolutely no consideration for the preservation of young fish from destruction. "All is fish that comes to their net," in the strictest sense of the term, and the apparatus they use is specially designed to take the smallest forms of aquatic life. Complaints have been loud and numerous on the part of other fishermen, and efforts have been made from time to time by the State authorities to put a stop to illegal and destructive methods. Judging from all the information obtainable these efforts have been only partially successful. A writer in the San Francisco *Bulletin*, alluding to the marked and growing scarcity of fish in San Francisco Bay, says:

> Another explanation which is now given is the ravages which the Chinese are making upon the young fish. Hundreds of these assumed despoilers of every blessing are employed constantly in catching the young fish, including every species in the bay, just developed from ova, in which work they employ fine nets, scoops, and other effective methods. This material is esteemed a prime delicacy among the heathen, large quantities being consumed in the city, and the business of preserving the young fish and shipping them to China has become an important enterprise. Thousands of young salmon, from 2 to 4 inches in length, may be found among the large supplies brought in daily to the fish shops in the Chinese quarters, and this is undoubtedly the true explanation of the alarming decline in the quantities of the best fish. The process continued for a few years will render salmon and other favorite species a rarity in these waters, and some enactment seems to be called for, to afford protection from this particular encroachment of the Chinese scourge.

The apparent bitterness of this statement might rob it of force were it not reiterated from various sources. This particular phase of the fishery has attracted the attention of every one who has taken any interest in the matter. Wilcox mentions the fact that at Hunter's Point he saw several basketfuls of thoroughly dried, broken fish scraps, among which was a large amount of whole fish (*Parichthys porosissimus*) not more than 1½ to 2 inches long.

Allusion has already been made to the destructive fishing with sturgeon trawls and fyke nets.

Regarding illicit fishing, Alexander says:

> The Chinese put the authorities to more trouble than all the other fishermen combined, and hardly a week passes without some guilty Oriental being dragged before the court for illegal fishing. This class of people seem to take pride in transgressing all laws established by the State. They invariably fish with fyke nets and sturgeon trawls whenever they think such fishing can be carried on with impunity. Frequently they are captured and their gear confiscated. During the past year [1889] 47 sturgeon trawls and several fyke nets were captured. These methods of fishing are carried on to a considerable extent in the San Joaquin and Sacramento Rivers. The

Italians, too, are more or less guilty of fishing with prohibited apparatus, but they do not so persistently violate the law as the Chinese.

There seems to be no way of ascertaining the number of sturgeon trawls and fyke nets employed on the rivers and bays adjacent to San Francisco Bay; but, judging from the frequent reports coming from different sources, it is to be presumed that illegal fishing is followed considerably. The quantity and kinds of fish which the Chinese of San Francisco expose for sale and export would indicate that a large percentage of their food-fish are caught by illicit methods.

Preparation of products.—The curing of fishery products for exportation is carried on during the entire fishing season. The fish are dried in the same manner as has been noticed in discussing Chinese methods of curing elsewhere, and scarcely anything is too minute to be excluded. Quantities of fish from 1 to 2 inches in length are dried for exportation.[*]

Drying shrimp for China.

The special feature of curing is the preparation of shrimp, which appear to be the most important object of fishery to the Chinese on San Francisco Bay and adjacent waters. Wilcox states that the vats in which shrimp are boiled, as observed by him at several of the camps, are very primitive and quite different from those heretofore described.[†] He noticed that a hole was first scooped out of the side of a hill or steep bank for the fireplace, and in this is placed the boiling vat or tank supported on a rudely built base-work of stones. The vat was 6 feet long on top, 5 feet on the bottom, 3 feet 4 inches wide, and about 2 feet deep. It had wooden sides and ends and a sheet-iron bottom bent up at each end. The water is first brought to a boiling heat before the shrimp are put into the vat, and they are allowed to boil about 10 minutes. They are then spread to dry upon gently declining or level stretches of hard ground which has been previously stripped of grass and rendered perfectly smooth. The shrimp yard at Hunter's Point is about 15 acres in extent. The Chinese use a hoe-like broom to spread the shrimp and to turn them as occasion requires. After being thoroughly dried by 4 or 5 days' exposure to the sun, they are crushed under large wooden pestles or trod upon by the Chinese in wooden shoes for the purpose of loosening the meats from the outer chitinous covering. The shells are then removed from the meats by shaking the shrimp in a basket or by passing them through a winnowing mill.

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[*] Alexander says: "This work is sometimes performed in a very discreet manner, especially when an unusual amount of illicit fishing has been going on."

[†] The kettle for boiling the shrimp is a rectangular iron tank 6 feet long by 4 feet wide and 2 feet deep, with a fireplace underneath. (The Fisheries and Fishery Industries of the United States, p. 806: "The Shrimp and Prawn Fisheries of the Pacific Coast," by Richard Rathbun.)

Mr. Rathbun says:

> This fanning-mill, which is rather a crude affair, is constructed of wood by the Chinese on precisely the same principle as the one used for winnowing grain. It measures about 8 feet long by 5 feet high, and consists of a square box divided on the inside for the passage of the separated shells and meats, with a hopper above, and a large fan wheel worked by a crank on one side.

Both meats and shells are then packed in sacks for exportation, though a small amount is sometimes reserved for local sale. All of the small and inferior kinds of fish are boiled, dried, and packed for exportation by nearly the same method used for curing shrimp.

Disposition of products, uses, etc.—The catch is partly used at home or sold at San Francisco or to the various inland Chinese settlements, but the great bulk of it goes to China. Shrimp shells have been utilized to some extent in California as a fertilizer, but nearly all of this material, like the meats, is exported to China, where it serves as manure for the tea plant, rice, etc. The usual price in San Francisco is 25 cents per 100 pounds. The meats are eaten by all classes in China, but are cheaper and less esteemed than native shrimps, which are comparatively scarce. Mention has been made of the utilization of certain products for feeding pigs and poultry. Shrimp, and also shrimp shells, are often fed to fowls, and are said to produce excellent results. They are broken up quite fine, soaked, and mixed with cracked wheat, oat meal, or corn meal.

Marketing.—The common custom is, at the end of each day's fishing, to carry a part of the catch, including fresh shrimp, to the San Francisco markets. The shrimp are transported alive in baskets; these are covered with netting having a central hole closed with a puckering string. The average price per pound of live shrimps is 10 cents; fresh fish fluctuate a good deal in value, and the price also varies with species. All that can not be sold in the market, or by hawking about the city, towns, or country, are taken back to the camps and immediately put through the process of boiling and drying for shipment abroad. Mr. Garibaldi estimated the value of shrimp sold at the Clay

Street market alone in 1879-80 at $2,000. The local consumption of shrimp amounts to about 300,000 pounds annually. In 1888 it reached 290,000 pounds, worth $23,200.

Exportation.—The export trade is entirely within the control of the Chinese merchants, who ship to the Hawaiian Islands and to Hongkong as a distributing center for China. It is impossible to determine accurately the amount of each species shipped from San Francisco by the Chinese, for many kinds are classed under one head. For instance, Alexander says that which comes under "codfish" in the records of the customs house is made up of cultus cod, red rockfish, flounders, sculpins, and various other species. That which is marked "other small species, shrimp, etc.," is composed of all kinds of small fish which the various devices known to those people will capture. Nor is it easy to tell precisely from what source the material is drawn; though it is less difficult to ascertain this, since certain species are taken in only particular localities and the records of transportation agencies are an important aid in solving this problem.

The tables showing the exportation of fishery products from San Francisco include such information as could be obtained from the customhouse records. A large percentage of the material exported is the result of the Chinese fishery, but includes the product of various other localities besides the region considered in this chapter.

The exports of shrimp should properly be credited to this region, and their consideration is a matter of interest. In 1887, 525,638 pounds of shrimp meats, valued at $58,698, and 1,752,718 pounds of shrimp shells, worth $16,468, were exported. In 1888 the exportations were 769,660 pounds of meats, valued at $76,966, and 3,842,200 pounds of shells, valued at $38,482.

THE OYSTER FISHERY.

Although the oyster business centering in San Francisco is thought to be only in its infancy, it has nevertheless assumed important proportions, the total value of the output in 1888 amounting to $509,175. It has naturally attracted attention, but, while its future is believed to be assured, its development is limited by conditions, natural or otherwise, tending to make the growth slow and to keep down the production to the actual needs of the market. At present there are only two firms employed in the business, and these were practically the pioneers in the trade.

The supply of edible oysters up to date is, according to the best authorities, largely dependent upon importation of "seed" from the Atlantic States. The native oyster (*Ostrea rufa*) of California is small, and has such a strong coppery flavor that it is comparatively little valued as food, and is not extensively eaten.

Soon after the opening of direct rail communication with the East, about 1869, the firm of A. Booth & Co. brought to San Francisco three carloads of live Eastern oysters of large size. It is said that this was the first shipment of live oysters from the Atlantic coast. But, according to the traditions of the trade, the market was overstocked by even this small invoice; consequently, to avoid loss, the shippers had to plant in San Francisco Bay all that could not be promptly sold. This experiment, the first attempt at planting oysters on the Pacific coast that we have any record of, resulted favorably. The oysters lived and thrived, and those interested gained valuable experience from the enforced experiment, while the financial result gave them confidence to enter more extensively into the business.

The following year "seed oysters" were imported from the East and oyster beds were started on a commercial basis. About 1871 Booth & Co. sold out their interest to the Morgan Oyster Company, which largely increased the business, not only supplying the city and suburban trade, but sending to the interior of the State shipments of canned "fresh-frozen" oysters. In 1877 M. B. Moraghan engaged in the oyster business at San Francisco, and in 1878 he began to import seed oysters from the Atlantic coast, which were planted in San Francisco Bay. From time to time others have made feeble attempts to go into the business, and have located beds and planted "seed" on a small scale. But these efforts have proved abortive, and those concerned in the attempts soon sold out their interests to the pioneer firms or have abandoned the business under even less advantageous circumstances. For this reason the entire oyster fishery of San Francisco Bay is now controlled by the two firms mentioned above.

Methods of planting, etc.—Two kinds of oysters are used for planting; these differ only in age and size and are called respectively "seeds" and "plants." Both kinds are brought from the Atlantic coast. No success has yet been met in breeding oysters in San Francisco Bay, and it is the belief of those familiar with the local conditions that the temperature of the water is unfavorable on account of the cold streams emptying into the bay.[*] For this reason the young oysters have to be obtained from the East. "Seed" are 1-year old oysters; they are left on the beds 3 years, after which they are taken up as required and the largest are sent to market, while the smaller ones are returned to the beds again. "Plants" are two years old and are left upon the beds 2 years before being culled for market. Thus the marketable age of the oysters in San Francisco Bay is about 4 years. It is generally agreed that oysters grow rapidly in these waters.

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[*] There is considerable difference of opinion, according to Wilcox, concerning the question of the propagation of oysters in San Francisco Bay. While some hold stoutly to the theory that there is no "set" of spat, or, if so, contend that it dies before reaching maturity, others point to the fact that young "seed" brought from the East thrives and grows exceedingly well. They naturally ask why young oysters that have hatched and set here should not do as well as those brought from distant waters. Some who have had long experience in the business concede that there is a limited natural set, and though this is a much-disputed point, the increase in the output of the beds following a reported decrease in importations would seem to give some reason for believing it. On the other hand, if it is a fact that the oyster breeds naturally, why then should it be necessary to replenish the beds with new "seed" and "plants," even so much as now? For surely the oyster has had ample time to become acclimated and to show the results of natural increase in a marked manner if the conditions are at all favorable. It is, therefore, easy to see that the evidence on either side is not yet of a decisive character.

"Seed" and "plant" oysters are brought from the Atlantic coast in spring and fall, when the conditions are most favorable. They are transported by the carload on freight trains, and are usually about three weeks on the road. With favorable weather they survive the journey with only small loss. The smallest oysters or "seed" stand transportation best and comparatively few of them die. From 85 to 95 barrels of these oysters are shipped in each car. No ice is used on them. A barrel will hold from 1,500 to 2,000 "plants," and from 4,000 to 8,000 "seed." The cost per barrel in New York is $3.50. A limited supply of full-grown oysters is brought from the East, but the quantity in 1888 was not nearly so large as formerly.

Freight charges fluctuate, but generally speaking the amount paid for transporting a carload of oysters from the Atlantic coast to San Francisco ranges from $400 to $450, or about $5 per barrel.

After it was demonstrated that young oysters would thrive in San Francisco Bay their importation increased rapidly. The largest amount received in one year during the past decade (1878 to 1888) is reported to have been 120 carloads. The average has been about 100 carloads annually. Lately, however, the receipts from Atlantic coast beds have decreased and in 1888 only 48 carloads of "seed" and 20 carloads of large oysters were imported from the East. This may perhaps be accounted for by the fact that recently quite large quantities of native oysters have been brought from the bays of the State of Washington (where they obtain greater excellence than farther south) and planted in San Francisco Bay.

These "natives" never grow to more than half the size of the Atlantic oyster, and they are often much smaller even than that. They have the strong coppery flavor previously alluded to, which they retain even after being transported. Many of the older citizens, having acquired a taste for the native oysters before any others were obtainable on the west coast, prefer them to those brought from the Atlantic. This preference has created considerable trade in the native variety. According to the best authorities, the oysters brought from Shoalwater Bay, Washington, do not thrive so well as those from the East after being planted in San Francisco Bay; consequently only enough are planted to supply the daily demand. No large quantity can be profitably put on the beds at one time, as they die if they remain long in the bay.

Size and location of oyster beds, etc.—The beds that supply the San Francisco market with oysters are located in San Francisco Bay, and mostly at or near its southern extremity. At Millbrae, San Mateo County, 17 miles south of San Francisco, two oyster companies own some 400 acres of "tide lands," about half of which is cultivated or used as beds. The oyster firms are credited with owning several thousand acres of "tide lands," but there are only some 300 acres in actual use for planting. According to the land-office register at Sacramento the available "tide lands" have all been bought up, both in San Francisco Bay and elsewhere along the coast. If any remain unsold they are in localities not easily accessible or not well adapted to oyster beds. The State sells the "tide lands" at $1 per acre, regardless of the purpose to which they will be devoted. It is believed that a considerable part of those lands have been bought purely for speculative purposes, and for this reason no record can be obtained of the quantity actually purchased for oyster beds.

In locating the beds, shell banks are preferred. As a rule these uncover, or nearly so, at low tide. The ground is first made smooth, and then covered with a layer of large oyster shells,* and over these are spread, as evenly and smoothly as practicable, the smaller shells of the native oyster. When the bed is completed the "seed" or "plants" are spread over as thickly as experience has shown to be profitable.

Enemies, protection, etc.—The oysters in San Francisco Bay do not suffer from the depredations of starfish, as they do in certain sections of the Atlantic coast waters. Here the enemy most dreaded by the oyster-planter is the stingray (*Myliobatis californicus*), which is found from Cape Mendocino southward. It is nearly as bad as the starfish on the east coast, and is a serious hindrance to the profitable prosecution of the oyster industry. The powerful jaws of these pests enable them to destroy the oysters whenever they can reach them. It is, however, comparatively easy to guard against their depredations by building fences around the oyster beds. These fences are made of 2 by 3 inch redwood scantling driven about 3 inches apart, and going about 4 feet into the ground. If the beds are much exposed to rough weather or sea, two, and sometimes three, rows of scantling are driven. The cost of fencing is considerable, the price of each piece of scantling being 12½ cents. The stingray appears in April and remains 4 months in the bay. After it leaves, openings are made in the inclosures to permit the tide to carry out the mud washed down on the oyster beds from the neighboring hills.

The oyster beds at Millbrae are located about a mile from the shore, and are owned and worked by the two companies before referred to, each having its own grounds fenced in. At low tide these beds are bare, or nearly so, but they are covered with 8 feet of water at high tide.

Methods of fishing, culling, transporting, etc.—Each of the two firms interested in the oyster business has a station consisting of a house built

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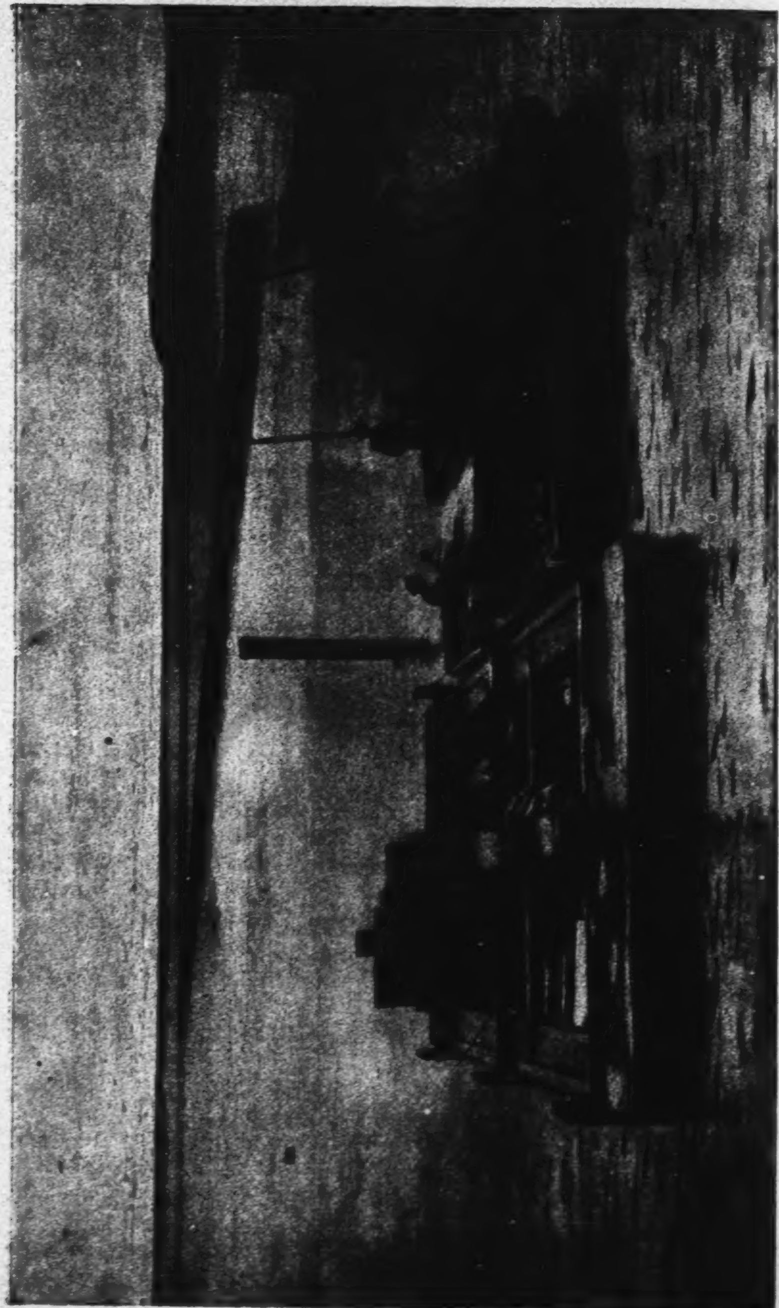
* These are collected from the hotels and saloons of the city.

Report U. S. F. C. 1888.—(To face page 157.) Pacific Coast Fisheries.

PLATE XX.



Culling Oysters, San Francisco Bay. Inclosed Oyster Beds in Background.

on piles, on or near its oyster beds at Millbrae. The employés live and sleep at these stations, and also keep their boats and scows there. A watch is kept to prevent depredations. One company has bored an artesian well 250 feet deep into the bottom of the bay; this furnishes an abundant supply of fresh water that is pumped into a tank by a windmill, and carried by piping a mile distant to its other station. The oysters are tonged and loaded upon scows. The latter are secured head and stern to stakes driven into the bottom so that the men can operate upon a spot until it is thoroughly worked over, when they move to a new location. In this manner they can go over the beds systematically.

The oysters are culled and packed in boxes, each of which holds 200, or put into sacks holding 36 pounds each. The filled boxes and sacks are loaded on the large cargo scow to await the arrival of the transport.

Six small sloops (the *Boss*, *Challenge*, *Leader*, *Dandy*, *Elsie*, and *Pet*)[*] are employed in carrying the oysters to San Francisco, where they are distributed to the trade in the shell or opened and put into tin cans that are packed in ice and shipped to towns in the interior or along the coast. A sloop will carry 150 boxes. Two cargoes, or 300 boxes, and 60 sacks, is the daily average taken to the city throughout the year.

The market price of oysters in the shell ranges from $1.50 to $2 per hundred. Packed in tin they sell as follows: Cans holding two dozen oysters each, $4 per dozen cans. Cans holding three dozen each, $6 per dozen cans. Cans holding four dozen each, $7 per dozen cans.

Trade.—The annual output of the oyster beds in San Francisco Bay amounts to 117,000 bushels (equal to 109,500 boxes) of large Atlantic oysters, with a value, at first hand, of $465,375; and 13,000 bushels (equal to 21,900 sacks) of native oysters, worth $43,800. This makes a total of 130,000 bushels with an aggregate value of $509,175. A limited quantity of fresh oysters in tins is brought from the East, the cans being packed in ice. The amount so disposed of is not important as compared with the product of the local beds, and exercises only a small influence on the market.

THE CANNING INDUSTRY.

When cognizance is taken of the vast resources which the city possesses in the way of fresh-fish supply; of the large extent of territory which is more or less dependent on it for fresh, preserved, and manufactured fishery products; of the many countries having no important fisheries that are in commercial relations with the western metropolis, it appears somewhat strange that fish-canning, which is of so much consequence elsewhere, has not taken a more prominent place among the industries of San Francisco.

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[*] Three of these are only sailboats, too small to be documented at the custom-house. The *Boss* is 11.40 tons; the *Challenge* 17.31 tons; the *Leader* 10.86 tons; *Pet* and *Dandy* 4 tons each, and *Elsie* about 2 tons. The total value is $3,800. The first three have crews of two men each; the other boats are managed by one man on each.

Salmon canning.—In 1888 only two fish-canning establishments were in operation in San Francisco. These were devoted to salmon-canning, but not exclusively, for considerable attention was paid to the preservation of fruit. The salmon utilized were mostly received from Humboldt County, although considerable quantities taken at the mouths of the rivers on the eastern side of San Francisco Bay were also used. The business was prosecuted with the most vigor when there was a surplus of fresh salmon in the San Francisco market and prices were low. In 1888 there were 453,700 pounds of salmon consumed in the preparation of 6,875 cases of canned fish. The fresh fish were valued at $22,685, and the resulting canned goods were worth, at the average price, $41,250, leaving $18,565 as the gross profits of the business. It seems probable that the salmon-canning industry of San Francisco is now almost as extensive as is warranted, taking into consideration the distance of the principal fishing grounds, the city's great demand for fresh salmon, and the enormous pack on other portions of the coast where better facilities exist. So far as other fish are concerned, however, San Francisco is seemingly the most available point in many respects, and there is reason to believe that it might maintain numerous factories for the utilization of the abundant supply of herrings, sardines, anchovies, and many other species found in the waters of the bay and the adjacent ocean.

Sardine canning.—An attempt has recently been made to establish at San Francisco a sardine-canning industry, but the business had not developed to important proportions in 1888–89, though a cannery had been started under competent management and some goods had been packed. As has been stated, the sardine of the Pacific is so much like the European sardine or pilchard (*C. pilchardus*) that it would be difficult for any one but an expert to tell one from the other, except, perhaps, by the difference in size, the western species being much the larger. Indeed, the chief obstacle to the profitable canning of the sardine at San Francisco is its size. It is well known that only the young or half-grown pilchards are used in Europe for the preparation of sardines. Fish of this size have been considered more delicate and better adapted to canning in oil than larger ones, and the trade has come to recognize this to the extent, at least, that it demands sardines of the standard size, or a close approximation thereto. Wilcox thinks that young sardines of suitable size for canning can be obtained for nearly half of the year, as the species migrates from point to point, being south in winter and moving north in spring and summer. This is a matter of great consequence, for the excellent quality of the Pacific sardine will undoubtedly bring it into high favor.

The anchovy, which is much smaller than the sardine and a most excellent food species, is a good substitute for canning purposes, and doubtless will in time come into marked commercial importance for this purpose.

It is pertinent to remark here that in the county of Cornwall, England, full-grown pilchards are canned in oil, like sardines, and have the trade name of "pilchards in oil." In 1883 I visited a cannery at Mevagissey, in Cornwall, and had opportunity to test the quality of the products. The "pilchards in oil" were excellent and quite as good as the smaller sardines. The demand for them was large and increasing.

In the New England sardine industry herring too large for "oils" are extensively put up in 1-pound cans with mustard, spices, tomato sauce, etc., and meet with ready sale. Fish from 6 to 8 inches long can be thus utilized. Larger individuals can be profitably put in 2-pound and 3-pound square, oval, or round cans. It therefore seems possible that the full-grown sardines of the Pacific might be utilized in this manner, and it is probable that time and a proper effort would overcome any prejudice now existing concerning the size of the fish.

STATISTICS.

The following statistical statements apply to the entire fishing industry of San Francisco and the adjacent regions embraced in this section, and show in detail the persons employed, capital invested, and results of the fisheries:

Nativity and nationality of persons employed in the fisheries of San Francisco Bay and vicinity in 1888.

Country.	Fishermen.		Shoremen.	
	Nativity.	Nationality.	Nativity.	Nationality.
United States	620	825	75	75
Mexico	3	3		
Central America	2	2		
South America	18	16		
Austria	2	1		
Belgium	1	1		
Denmark	20	14		
France	13	10		
Germany	55	46		
British Provinces	221	182		
Greece	36	30		
Holland	3	3		
Italy	114	49	25	25
Norway	124	118		
Portugal	145	98	40	40
Russia	74	52	30	30
Spain	40	42		
Sweden	151	136		
China	807	807	80	80
Japan	20	29		
Sandwich Islands	15	18		
South Sea Islands	14	12		
Total	2,512	2,512	250	250

Apparatus and capital.

Designation.	No.	Value.
Vessels (tonnage 11,820.65)	71	$1,032,500
Outfit (not including apparatus of capture)		410,075
Boats	433	98,030
Apparatus of capture as follows:		
Gill nets	1,322	80,720
Trammel nets	315	14,175
Seines, bag nets, etc	1,862	44,275
Pots	1,200	2,300
Hand lines, trawl lines, and minor apparatus		17,955
Shore property		105,000
Cash capital		155,000
Total		1,969,030

Summary, by fisheries, of the San Francisco vessel fisheries in 1888.

Fishery.	No. of vessels.	Net tonnage.	Value of vessels and outfit.	No. of fishermen	Value of catch.
Whale	28	8,278.40	$1,041,000	932	$692,985
Fur-seal and sea-otter	13	630.52	104,700	213	69,255
Cod	9	1,689.72	125,800	198	69,947
Market	2	41.00	16,500	12	5,200
Fur-seal, salmon, and oyster freighting	20	1,180.86	164,850	96	
Total	71	11,820.65	1,452,850	1,451	847,387

Products and values.

Species.	Quantity.	Value.
Fish:		
Salmon, fresh .... pounds..	428,000	$30,200
Shad, fresh .... do....	14,000	1,120
Other fresh fish .... do....	6,282,554	402,473
Miscellaneous dried fish .... do....	4,250,000	101,760
Total	10,974,554	535,553
Mollusks:		
Oysters .... bushels..	130,000	509,175
Clams and mussels .... pounds..	2,294,415	75,348
Abalone shells and meats .... do....	2,000,000	55,000
Octopus and squid .... do....	14,000	1,120
Total		640,643
Crustaceans:		
Crayfish .... pounds..	25,000	2,000
Crabs .... do....	230,000	37,200
Shrimp and prawn .... do....	4,902,360	141,688
Total	5,157,360	180,888
Reptiles:		
Terrapins and frogs .... number..	51,000	12,900
Mammals:		
Skins of hair seals, sea lions, and walrus ... number..	121	4,265
Pelts of fur seal .... do....	*104,455	1,576,730
Pelts of sea otter .... do....	2,646	215,150
Whalebone and walrus ivory .... pounds..	197,080	585,565
Whale and seal oil .... gallons..	284,950	102,564
Total		2,484,273
Grand total		3,854,257

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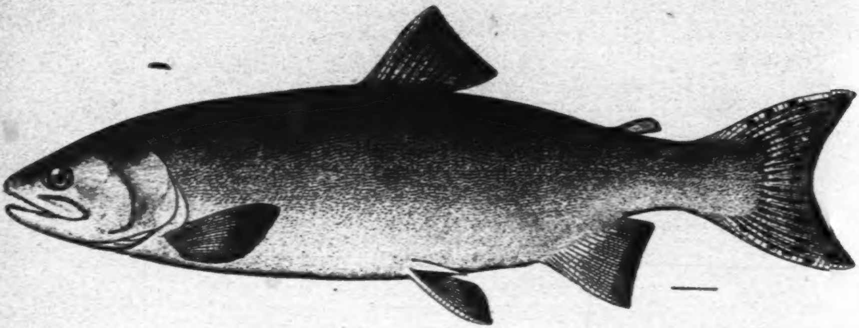
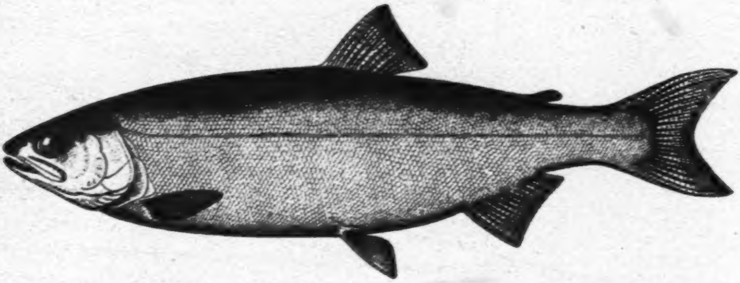
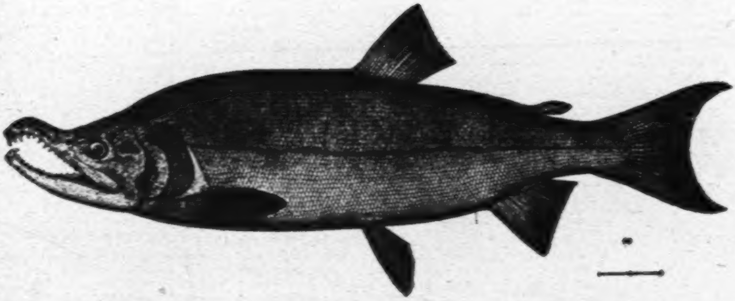
* These figures include the number and value of fur-seal skins taken at the Pribilof Islands, in Bering Sea, which are a product of a fishery carried on by San Francisco capital. In 1888 the full limit of 100,000 skins was obtained at those islands, the value of which, as laid down at London, where they were sold, was estimated to be $1,5[illegible],000. In addition to the foregoing, the fur-seal industry of the Commander Islands (which belong to Russia) was controlled by American capital and the product was brought to San Francisco. In 1888 this amounted to 47,[illegible] skins of fur seals, having a value of $[illegible] at the average price paid in London. Combining these figures, we have as the total yield of the fur-seal industry in 1888, $2,131,[illegible].



HUMPBACK SALMON (*Oncorhynchus gorbuscha*). Sea-run.



BLUEBACK OR RED SALMON (*Oncorhynchus nerka*). Sea-run.



BLUEBACK OR RED SALMON (*Oncorhynchus nerka*). Breeding male.

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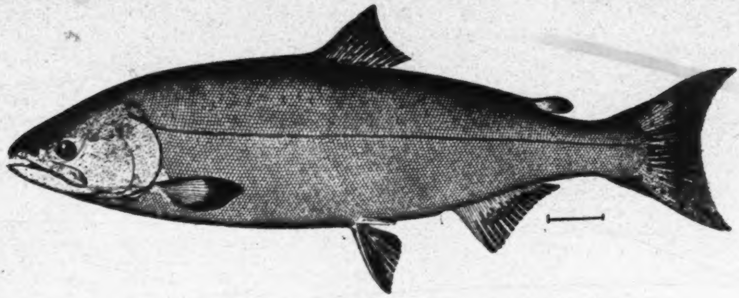
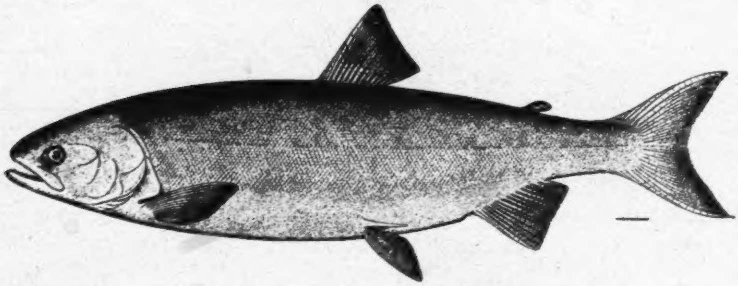
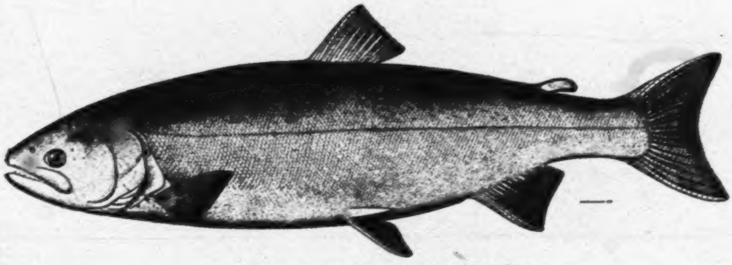


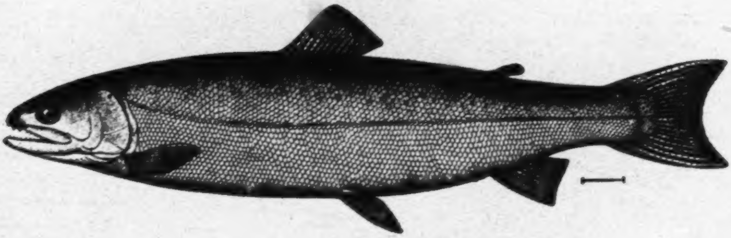
KING, CHINOOK, OR QUINNAT SALMON (*Oncorhynchus chouicha*).



DOG SALMON (*Oncorhynchus keta*).



SILVER SALMON (*Oncorhynchus kisutch*).



STEELHEAD (*Salmo gairdneri*).

21. FISHERIES OF THE SACRAMENTO AND SAN JOAQUIN RIVERS, INCLUDING PARTS OF SUISUN AND SAN PABLO BAYS.

Geographical characteristics, etc.—The Sacramento and San Joaquin are the two most important rivers in California, and the watershed of a large portion of the State is tributary to them. The Sacramento rises in the Trinity Mountains, a spur of the Sierra Nevada range. Its general trend for the first few miles is northerly to the point where it is joined by the Pit River, thence it winds its zigzag course in a west-southwesterly direction until it reaches the valley east of the Shasta range of mountains, when it turns abruptly southward; thence its general course is nearly south-southeast until it empties into Suisun Bay. The lower part of the river, however, below Sacramento, runs southwesterly. Fed by the melting snows on the mountains, its head-waters are specially adapted to the salmonidæ; they constitute favorite breeding-grounds for salmon, and have long been justly celebrated for an abundance of large trout. The lower part of the river is adapted to fishes of other species which do not require such a low temperature as the trout and salmon.

The San Joaquin has its source in the Sierra Nevada Mountains. Flowing westerly through Fresno County for the first 50 miles of its course, it then turns abruptly to the north just where it is joined by Fresno Slough, which drains Lake Tulare.* From this point its general course is northwesterly through the counties of Fresno, Merced, Stanislaus, and San Joaquin, and it passes between the counties of Sacramento and Contra Costa, where it joins the Sacramento River, near the latter's mouth. The Chouchilla and Fresno Rivers, both of which rise in the Sierras, are the principal tributaries of the San Joaquin. The latter is about 350 miles long, and of considerable size, but muddy. The fisheries are unimportant, except near the mouth of the river. In the upper part of the river, catfish, perch, and suckers are reported abundant, while sturgeon, shad, pike, and salmon are the most important varieties in the lower reaches of the stream. Comparatively few salmon enter the San Joaquin, and these rarely go very far up river. It is probable that the muddy condition of the water, and possibly the temperature, prevent salmon from ascending to the headwaters.

Fishing centers.—The principal fishing centers are Sacramento, Sutterville, Clarksburgh, Courtland, Walnut Grove, Rio Vista, Black Diamond, Collinsville, Chipp's Island, Benicia (on Karquines Strait), Martinez, Porte Costa, and Vallejo. A considerable number of salmon fishermen live at Jersey Landing and Antioch, on the San Joaquin, but fish in both rivers and the adjacent bay. The Central Pacific Railroad passes through the towns located on the south side of Suisun Bay and the mouth of the San Joaquin, and a branch of this road runs from Sacramento to Benicia and Vallejo. At several of these places are located salmon canneries, to which the fisheries are in large measure tributary. Considerable quantities of fish besides salmon are taken to supply the local trade along the rivers, including the places referred to, and to ship to San Francisco and the interior.

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*On some maps Fresno Slough is given as the headwaters of the San Joaquin.

Species, seasons, etc.—Salmon of large size and excellent quality are abundant in the Sacramento in their season. The period of greatest general abundance is from April to the last of August. A few are caught all through the other months, except September, which is the close season. The largest catch is in April, May, and August. There is a dull season from the middle of June to the middle of July, during which time the canneries usually suspend operations. The catch during this period is sold fresh for immediate consumption. The quinnat or king salmon is the one chiefly taken; the dog salmon (*O. keta*) and the humpback salmon (*O. gorbuscha*) occur in less numbers, while there is a fall run of silver salmon, according to Jordan.

The weight of the salmon varies from 5 to more than 50 pounds, and the ordinary weight ranges from 14 to 18 pounds. The largest are generally taken in August, but an occasional big salmon is caught in early spring. Formerly the largest fish were always found in the "spring run."

During the last 10 days in August, 1888, the largest catch of the season was made; salmon were reported more abundant than they had been for many years. On some occasions during this period the canneries at Chipp's Island and Black Diamond handled as many as 18,000 salmon (more than 270,000 pounds) in a single day, and this notwithstanding they could not, on account of inadequate facilities for packing, receive many boatloads of fish that were offered. The spring catch of 1889 showed an important improvement over the early fishing of 1888. The fish were larger than usual, being fully equal to the ordinary fall run of salmon, and were more numerous than for several previous years.*

The shad has become one of the commercially important species of the Sacramento River, where, next to San Francisco Bay, the largest yield of this fish is obtained. It is most numerous in the lower river, but many shad are taken as high up as Sacramento. The average weight is 5 pounds. In 1889 the first shad taken in the upper river were caught near Sacramento on April 23; they weighed 4 pounds each.

Trout of large size occur in the upper river. They were formerly very plentiful, but have materially decreased in recent years. This diminution is believed to be due chiefly to the large quantities of sawdust in the river. A law has recently been enacted by the State making it illegal to throw sawdust into the river after September, 1889, and it is hoped that the effect will be beneficial.

Catfish, carp, chub, hard-head, and split-tail are taken in greatest numbers above Sacramento, mostly in fyke nets. The same species occur in the upper part of the San Joaquin, but there is no regular fishery for them there. Perch, pike, and sturgeon are found in both rivers; the latter average 35 pounds in weight. Striped bass are occasionally caught. One taken about April 17, 1889, near Benicia, weighed 24 pounds; it sold at retail for $1 per pound.

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*It has been noted by Mr. Wilcox that these seasons of abundance had a direct relation to the operations at the hatching station of the U. S. Fish Commission on the McCloud River. Large plants of salmon fry have generally, if not invariably, been followed (3 or 4 years later) by good catches of fish in the Lower Sacramento.

Terrapin occur in the marshes near the mouths of these rivers, and are taken in limited numbers for the San Francisco market.

Fishing grounds.—The fishing grounds for salmon are generally Suisun Bay, the lower part of San Joaquin River, and the Sacramento River as high as the vicinity of Sacramento City. Next to the Columbia River, the Sacramento is the most important salmon stream of the Pacific coast States. The fishermen of each district generally go no farther than 5 miles above or below the cannery or steamboat landing where the catch is landed. Salmon do not run into the San Joaquin in large numbers. In the fall, when the fishery is at its best, fishermen go a few miles up the Mokolumne, a small stream that empties into the San Joaquin, about 20 miles or so above Black Diamond. Three-Mile Slough, some 5 miles nearer the town mentioned, is also fished to some extent.

Fishermen and shoresmen.—The fishermen on the rivers are almost wholly of European birth, though about 30 per cent. of them have become naturalized citizens of the United States. Of the 1,102 fishermen working in the region under discussion, only 60 were born in this country, 477 were natives of Italy, 425 came from Portugal, 150 from Sweden, and 90 from Germany. The Swedes have shown the greatest desire to become citizens, 70 per cent. of them having been naturalized.

Many of the fishermen are unmarried, and these find it most satisfactory to live upon scows, which, as the salmon migrate and the centers of abundance change, are towed from one part of the river or bay to another to suit the convenience of the occupants. Some of the married men have large scows, upon which are 2 or 3 rooms, and these generally take their families along with them and follow the fleet of boats and scows up and down the river. Generally, however, those who have families live on shore with them. During the close season for salmon, or when the catch is light and the canneries closed, the scow towns break up, and many of the fishermen go to the places they consider home. But when the season begins and the canneries are running they take to the bay and rivers, where their unique habitations may be found along the shores near the best fishing grounds.

Of the 295 men in the canneries 40 are natives of this country, and the remainder are Chinese. The Americans are the bosses, clerks, etc., while the Chinese constitute the "help."

Regarding the employés in the canneries, it is proper to state that it is somewhat difficult to arrive at the figures with exactness. Some of the packing establishments also do an extensive business in canning fruit, and there is necessarily a commingling of interests. The number of persons employed, even at the canneries that handle salmon exclusively, fluctuates considerably. In periods of abundance all available "help" is procured, but any decrease in the supply of fish is immediately followed by a corresponding diminution in the force. The figures already given represent the average number of employés which can properly be included under the head of salmon canning.

Vessels and boats.—During the salmon season there were 12 small vessels employed on these rivers and adjacent waters in the capacity of tenders or freighters for the canneries. They visit the principal fishing grounds and collect the catch of the boats, which they transport to the respective canneries they are working for. With one exception these are all sloops; two of them—the *Boss* and *Challenge*—are employed part of the year as transports in the San Francisco oyster trade, and have been mentioned in that connection. The size ranges from 5 to 17 tons; the average is about 12 tons.

These vessels are owned at San Francisco, Vallejo, Benicia, and Black Diamond, but all are documented from the San Francisco custom-house and hail from that port; they have therefore been included with the statistics of that city, though, for the sake of clearness, they are mentioned here. These vessels are in no sense typical fishing craft. Many of them are old; they are of varying models, and there seems to be no effort made to keep them in shipshape order. So long as they hold together and can carry a cargo of fish in smooth water, nothing else appears to be required. The value ranges from $250 to $500 each. Two men constitute a crew. Their names, rig, and net tonnage are shown in the following list:

Name.	Rig.	Net tonnage.	Name.	Rig.	Net tonnage.
Boss	Sloop	11.41	Josephine	Schooner	16.41
Challenge	do	17.31	Knickerbocker	Sloop	5.61
Colonel	do	9.61	Liberty	do	12.74
Fannie Sames	do	10.46	Lizzie M.	do	16.14
Ida	do	14.74	May Fowler	do	15.86
J. A. McClellan	do	9.46	Twilight	do	10.16

The typical salmon gill-net boat is used here for fishing, but it is not so large, on an average, as the boats on the Columbia River, and has less stability and seaworthiness.

The scows on which many of the fishermen live are much like the "arks" used by the gill-net shad fishermen on the Potomac River. They are variable in shape and appearance; flat-bottomed, with vertical parallel sides narrowed and slanting somewhat toward each end. They are boarded over above and are nearly covered by the house, only a narrow margin being left around the sides. The house generally has but one room with a door at one end and two windows on each side. It is flat-roofed. Probably an average-size scow would be 20 feet long and 12 feet wide, the house about 7 feet high and occupying all of the scow but a strip about 18 inches wide on each side and 2 feet wide at each end."* The average value of a scow is estimated at $250.

Apparatus and methods of capture.—Gill nets are exclusively used in the salmon fishery. Wilcox states that the salmon nets now in use on the lower Sacramento range in length from 150 to 300 fathoms and in depth from 4 to 5 fathoms, or 40 to 45 meshes of 8 to 8½ inches each. He places the value at from $200 to $400. There seems to have been a decided change in the depth of this apparatus in the past 10 years. Jordan and Gilbert found the nets used in 1879 to be "from 200 to 300 fathoms long, from 6 to 9 fathoms deep, and with an average mesh of 8½ inches." They place the value at $300. Nets of this size are operated only in the bays and lower sections of the rivers, where most of the catch is obtained. In the vicinity of Sacramento City, the upper limits of the fishery, nets are much smaller, ranging from 75 to 100 fathoms in length, and usually having only a 7½-inch mesh. From Rio Vista to Carlinville the nets are from 150 to 250 fathoms in length; and between the latter place and Benicia they vary from 200 to 300 fathoms. The nets are all handmade by the fishermen during the dull season; they usually last about 2 years. Some of the men, however, prefer to engage in some other pursuit at that time and pay the net-makers for knitting and hanging their gear.

Jordan and Gilbert, in the same article, make the following reference to the method of fishing:

> Fishing is always done on the ebb tide, whether it be day or night. Two men always work together. They go out to their fishing grounds, which are chosen chiefly by clear channel, and the net is placed in the water, one man working the boat and the other paying out the net. Everything is governed by laws which the fishermen have made for themselves. Each of the two men has his own part in the work. It is always the same one who rows, while the other manages the net. The two then rest in their boat, boat and net floating down together until they have gone far enough, when the net is taken out and the fish removed. The distance they float, of course, varies with the grounds and the seasons.
>
> According to a law among fishermen, a second net is not to be placed in the water until the first one has floated down a certain distance, and although the fish are all caught running up the stream the second, third, and even fourth net frequently catches more than the first. They generally begin fishing at about half ebb tide.

In spring, when the water is muddy, the day fishing is generally as good as at night. Later in the season, when the river is comparatively clear, the best results are obtained at night, particularly when there is no moon. A State law prohibits net fishing between sunrise on Saturday and sunset on Sunday, in addition to total cessation during September. The laws are said to be often violated, notwithstanding the patrol of the river by the State fish commissioners.

Shad are taken incidentally in the salmon nets.

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*The Salmon Fishing and Canning Interests of the Pacific Coast, by David Starr Jordan and Charles H. Gilbert, volume I, section V, of Report upon the Fisheries and Fishery Industries of the United States, p. 732.

Hoop nets are used to some extent by the Chinese employés at the canneries for the capture of catfish, which gather around the wharves and buildings, attracted by the refuse thrown into the water. Fyke nets are used about Sacramento for the capture of several varieties of coarse fish. "They include chubs, herring, perch, viviparous perch, sturgeons, hard-heads, split-tails, Sacramento pike, suckers, crabs." The fyke nets usually have a 2½-inch mesh and wings about 14 feet long. Each net has 4 hoops. They are set close inshore, and the best results are obtained when the river rises and the fish run in near the banks. Fishing with fyke nets is carried on from November to May. It is discontinued in summer because the water is warmer and the fish poor. The nets are generally lifted each morning, and the fish are shipped to San Francisco the same day, at least such as are not sold locally.

The extent of the salmon fishery, past and present.—In the early days of the salmon fishery on the Sacramento old inhabitants state that as many as 1,000 boats were used on the river between Sacramento and San Francisco Bay. Both boats and nets were then much smaller than they are at present. In 1888, 504 boats were employed on the two rivers in addition to about 150 others engaged in the fishery from San Francisco and vicinity, which have been included with the statistics of San Francisco Bay.

After October not more than 75 boats are usually engaged in salmon fishing, and practically the entire catch is sold fresh, for immediate consumption, either in the towns or peddled through the country. None of the product at that season is used for canning. The following table shows the quantities of salmon taken at the various points for the canneries and for sale in the markets:

*The salmon catch of the Sacramento.**

District.	Sold to canneries.	Sold to markets for food.	Total catch.
	Pounds.	*Pounds.*	*Pounds.*
Sacramento	47,500	[illegible]	[illegible]
Rio Vista	31,000	[illegible]	[illegible]
Black Diamond	2,772,000	1,439,100	4,211,100
Benicia	1,160,000	[illegible]	[illegible]
Total	†4,[illegible]	1,[illegible]	[illegible]

*The figures given in this table include salmon caught on the San Joaquin and packed in the canneries or otherwise disposed of.

†The canneries at these points packed 61,200 cases; 66 pounds of undressed fish being, on an average, required to fill a case.

Salmon-canning.—There is a cannery at Benicia, one at Black Diamond, and a branch cannery at Chipp's Island; these take most of the salmon caught in the lower Sacramento and San Joaquin Rivers, and also those obtained for canning purposes in Suisun Bay. A cannery at Sacramento is supplied with fish caught higher up the river.

The canning of salmon on the west coast of the United States had its origin on the Sacramento River in 1864. Since that time the growth of the industry on the Pacific coast has been one of the most remarkable features in the history of the fisheries of this country.

Messrs. A. S. Hapgood, William Hume, and George W. Hume, under the firm name of Hapgood, Hume & Co., built the first cannery on the coast. This event was fraught with such important consequences to the Pacific coast that it seems worthy to be recorded in detail. The gentlemen who had inaugurated this enterprise had resided in Augusta, Maine, in their boyhood days. William Hume went to Sacramento in 1850 and his brother George followed in 1855. In 1863 the latter returned home, where he met his former schoolmate, Hapgood, who in the mean time had learned the tinner's trade and had also been engaged in canning lobsters on the Bay of Chaleur, New Brunswick. Hume had observed the abundance of salmon in the Sacramento. He had also lived on the Kennebec, and knew the commercial value of this "king of fishes." Having a mind that was quick to grasp possibilities, the thought naturally occurred to him: If lobsters can be canned for food, why can not salmon be treated in the same way, and the wealth of the Western rivers thus be given to the world? A few conversations with his friend led to preliminary arrangements for the establishment of the firm above named, and the inauguration of a business that has reached proportions not anticipated in the wildest dreams of its originators.

After Hume's return to California his action was ratified by his brother, and, on March 24, 1864, Hapgood reached Sacramento. Ten days earlier, Mr. Robert D. Hume arrived in California and immediately became connected with his brothers as an employé in the firm. Preparations for canning salmon were immediately begun. The cannery was on a floating scow, located in the town of Washington, on the opposite bank of the river from Sacramento. Many difficulties, due to inexperience and crude devices, were met with, and some losses were unavoidable. Nearly 4,000 cases (4 dozen 1-pound cans in each) were packed the first season, but only 2,000 cases were merchantable; the remainder of the pack was worthless and was thrown away.

The machinery and apparatus were very rude, compared with modern devices. The fish was first put into the cans and then boiled in large, round-bottomed iron kettles. Fresh water was used to boil the fish in. The cans, with their vent-holes left open, were placed in the kettles so that the water would not come within an inch of their tops. The boiling continued an hour, after which the cans were taken from the kettles and the vents closed. No test for leaks was made. Next the cans were thrown loose into a bath kettle made of boiler iron. In this salt water was used so that a higher temperature could be obtained; the heat was generally from 228° to 230° F. This frequently burned out the kettle, and many imperfectly made cans were burst and their contents lost. Steam was not used at that time in cooking or otherwise preparing the products. After an hour's bath, the cans were scooped out of the bath kettle and placed in a tank filled with cold water; they were then wiped off with old rags, and often were left in a rather untidy and unattractive condition, so far as outward appearance was concerned. The ends of the cans were covered with red lead, and in some cases the entire cans were painted. They were then labeled and packed in cases.

The difficulties of the enterprise were not confined to packing, for when the goods were offered for sale in the San Francisco market no one could at first be induced to purchase or even to handle material so entirely unknown to the commercial world. Finally, one commission firm was found that advanced the shipping charges on a part of the pack, which was sent to Australia. The venture was a success; the salmon sold readily and netted $16 per case. As soon as this result was learned the rest of the pack was shipped to the same market, where it met with an equally good reception.

And thus was the salmon-canning industry of the west coast established, and from this small beginning has grown one of the great fisheries of the world, the products of which have become familiar wherever civilization exists.

During the season of 1864, 1865, and 1866, particularly in the latter year, the run of salmon was unusually light on the Sacramento. Packing continued and a good trade was built up with Australia and South America. No sales of canned salmon were made in the United States at that time, since the lack of proper facilities for transportation and ignorance of the value of such products hindered their distribution in this country; but the demand grew rapidly and the scarcity of fish on the Sacramento made it necessary to look for new sources of supply. In the spring of 1866 the Columbia River was visited and the conditions were so favorable that the firm built a cannery at Eagle Cliff, 40 miles above Astoria—the first cannery on the river—and thus became the pioneers of the salmon fishery in that region.

In recent years the supply of salmon on the Sacramento has been diminishing, and, as a consequence, many canneries have devoted considerable time and effort to the packing of fruit, including berries, while other packing establishments have been moved to Alaska.

According to statements of packers, the best season in recent times for salmon was in 1881, when this species was very abundant in the region under discussion. In 1882 and 1883 good catches were made, but the yield was considerably less than in 1881. The years 1884 to 1886, inclusive, showed a large decrease in the supply, and in 1887 the season was the poorest ever known. There was, however, a most gratifying increase in 1888, although the catch did not reach the proportions that it had attained in some of the earlier years.

During the season of 1888 four canneries were operated on the Sacramento River. These were located, respectively, at Sacramento, Black Diamond, Chipp's Island, and Benicia. They employed 295 persons, mostly Chinese, and utilized 4,069,200 pounds of salmon, for which the fishermen received $201,960. The output of the canneries that year was 81,200 cases, for which $390,156 were received. Four other canneries on the river were not in operation in 1888. Only three were open in 1889, and 57,300 cases of salmon were packed.

The lay.—The boats and nets are generally the property of the fishermen, who fish on shares. In case the fishermen do not own the apparatus, the stock of each crew is divided into three parts, one going to the owner of the net and one to each of the fishermen.

Disposition of products.—Previous to 1888 the salmon were sold to the canneries by the piece at prices ranging from 50 to 70 cents each for all fish weighing 10 pounds or over; under that limit two fish were required to represent the value of a single fish over 10 pounds. In 1888 the packers, finding that all large salmon were being sent to market and all the smaller fish sold to them, changed the system and decided to buy the fish by the pound, regardless of size, the prices paid in that year being 4½ to 6 cents, round. Large quantities of various species of fish are shipped in ice to San Francisco and other markets for immediate consumption.

Sacramento as a fish market and distributing center.—Although a certain amount of fresh-water fish is shipped from Sacramento to San Francisco, the receipts of salt-water fish from the latter place are much greater. The following table shows the receipts of market fish at Sacramento in 1888:

Species.	No. of fish.	Pounds.	Value to fishermen.
Salmon	18, 291	155, 290	8, 317
Shad	262	1, 471	74
Sturgeon	147	5, 128	256
Pike	36	378	19
Carp		35, 475	532
Catfish		125, 946	1, 889
Hard-head		30, 450	609
Split-tail		32, 149	643
Chub		1, 260	63
Total	18, 736	387, 374	12, 401

The following were the ruling prices received by the fishermen of this region in 1888:

Prices of different species of fish, 1888.

Species.	Price per pound.	Species.	Price per pound.
	Cents.		Cents.
Salmon, upper river	4½	Sturgeon	5
Salmon, lower river	6	Hard-head	2
Shad	5	Split-tail	2
Carp	1½	Chub	5
Catfish	1½	Perch	5
Pike	5		

The extent of the fisheries on the Sacramento and San Joaquin Rivers in 1888 is shown in the following tables:

Persons employed.

Country.	Nationality.		Nativity.	
	Fishermen.	Factory men.	Fishermen.	Factory men.
United States	[illegible]	40	[illegible]	40
Italy	[illegible]		477	
Portugal	[illegible]		[illegible]	
Sweden	105		[illegible]	
Germany	[illegible]		[illegible]	
China		[illegible]		[illegible]
Total	1,[illegible]	[illegible]	1,[illegible]	[illegible]

*Apparatus and capital.**

Designation.	Number.	Value.
Boats	[illegible]	$[illegible]
Gill nets	[illegible]†	[illegible]
Fyke nets	[illegible]	700
Building, wharves, machinery, land, etc.		[illegible]
Cash capital		[illegible]
Total investment		[illegible],700

* The small vessels engaged in transporting salmon to canneries on the Sacramento and San Joaquin Rivers have been included in the statistics of San Francisco, where they are owned and documented.

† [illegible] feet in length.

Products and values.

Species.	Pounds.	Value.
Salmon, fresh	[illegible]	$[illegible]
Salmon, pickled	120,000	[illegible]
Salmon, canned	[illegible]	[illegible]
Catfish	[illegible]	[illegible]
Carp	[illegible]	[illegible]
Perch	[illegible]	[illegible]
Pike	[illegible]	[illegible]
Sturgeon	[illegible]	14,411
Shad	[illegible]	[illegible]
Hard-head	[illegible]	[illegible]
Split-tail	[illegible]	[illegible]
Chub	1,200	[illegible]
Total	[illegible]	[illegible]

Additional products, [illegible] terrapin, $[illegible].

22. FISHERIES OF MENDOCINO COUNTY.

The shores of Mendocino County are bold and rocky and not adapted to fishing, nor has the county any rivers of note. So far as could be learned, there is no commercial fishing, and at the best it is believed there has been no advance since 1880, when Jordan estimated that the total annual catch could not exceed 3,000 pounds.

[illegible] FISHERIES OF HUMBOLDT COUNTY.

Geographical characteristics.—The land is bold and high along the coast of Humboldt County on the south and north, but in the center of the county, in the vicinity of Humboldt Bay, the shores are rather flat and less striking. The coast is generally unsuitable to sea fishing; there are no inlets or harbors of importance, except at Eureka, on Humboldt Bay, and as this is barred and the sea is usually breaking heavily on the bar, it is comparatively seldom that boat fishermen could be assured of returning safely to the harbor, even if they succeeded in getting to sea. Access to the bay is rendered dangerous for vessels by the narrow, shallow, and shifting character of the channel at the entrance. Humboldt Bay is 12 miles long and about one-quarter as wide. The Mad River enters it on the north and the Eel River empties into the southern extremity of the bay.

Character of the fisheries.—The fisheries of this county are confined to Humboldt Bay and the two rivers mentioned. The only fishery that is prosecuted on an extensive commercial scale is that which has the salmon for its object. There are, of course, besides the salmon, many other varieties of fish, some of which are taken incidentally.

Species, etc.—Several varieties of salmon are recognised by the fishermen, which they know as the silver, hook-bill, dog, steelhead, and humpback salmon. The latter are small, not exceeding 10 pounds in weight on the average, but the general average of salmon is said to be 25 pounds. There is no spring run of salmon in the Eel River. Unlike many salmon streams, it is not fed in the spring by melting snows, but is dependent upon local rains for a full supply of water; consequently it is frequently quite low during the time when salmon are ascending the coast rivers and it is believed that this is the reason why salmon do not enter it in the spring. During the fall and winter, however, fish are abundant; they enter the stream about the first of October and remain until March. In the latter part of the winter the catch is made up largely of steelheads, which are almost entirely absent in the early fall run.

Shad have occasionally been taken in recent years and are increasing in abundance. There is no regular fishery for them, and consequently their actual relative abundance is not known. Those taken are caught incidentally—chiefly in salmon gill nets—the mesh of which is too large to take shad of an ordinary size. In 1888 as many as twelve shad were taken at one haul in a salmon drift-net, which had a 7½-inch mesh, this being the minimum size permitted by State laws. A few shad are annually taken in Humboldt Bay. They first appeared in 1882. About one hundred were reported caught in 1888. Brook trout are numerous in parts of Eel River. Below the forks perch and suckers occur; within a few miles of the mouth flounders are found; and during the summer months herring, smelt, and sardines are plentiful in the bay.

Clams are abundant on the flats about Humboldt Bay; there are several varieties, locally known as soft-shell, small round hard-shell, quohaug, and razor clams. There is no organized fishery for them. The Indians dig a few for local consumption and sell about fifty buckets per week at the two fish markets on the bay, the average price received being 50 cents a bucket.

Fishermen, lay, etc.—A few of the men employed in the fisheries of the Eel River reside in the valley of that stream, but the majority are non-residents of the county who visit the region annually for the purpose of engaging in the salmon fishery, some being from the Columbia River. At Eureka the men are devoted to other business during a greater part of the year. Some fishermen work on shares and others are hired by the month. There is a large foreign element among the fishermen, the countries of Portugal, Italy, Sweden, and Russia all being well represented. The only Chinese in the county are those employed in the canning house, which, however, was not in operation during 1888. These Chinese are hired at San Francisco by the owners of the factory and imported for the season, but leave immediately after the cannery closes.

Boats.—The boats used in this locality are small and inexpensive. The average dimensions are 16 feet in length and 4 feet beam; they have a square stern and flat bottom. Those employed in the gill-net fishery carry one net and two men each. The average value is $20.

Fishing grounds, apparatus, methods, etc.—In October and November, when the bulk of the catch is made, drift nets and seines are operated in the lower 6 miles of the river's course; after the middle of November high water is liable to occur and the fishermen then work the stream as high up as the forks, some 40 miles from its mouth. No regular salmon fishing is done above the forks, although the people living along the banks of the stream catch salmon for their own consumption. The winter yield is light and is chiefly taken with seines in the upper part of the river.

The gill nets operated on the Eel River are 60 fathoms long and 3 fathoms deep; the nets used in the early part of the season have a 9-inch mesh, but later, when salmon are sought in the upper river, nets with a 7½-inch mesh are preferred. The nets are mostly made by the fishermen themselves, and have a value of $50 each. The salmon nets used on the Mad River are from 100 to 150 fathoms long, 14 and 15 feet deep, with a 7½-inch mesh; they are worth from $100 to $150 each. The Eureka fishermen use gill nets about 40 fathoms long, 14 feet deep, with a 2-inch mesh, for catching perch and flounders.

The haul seines operated on the Eel River are factory-made, 150 to 200 fathoms long, 4 fathoms deep in the bunt, and 3 fathoms in the wings; the average value is $300 each; there are 15 in use, and 8 or 9 men are required to operate each of them. There are, in addition, 4 seines fished from Eureka, usually for smelt, herring, and sardines;

these are smaller than salmon seines, and are worth $100 each. Hand-lines are occasionally used in this region, but the catch is small.

Disposition of products.—Owing to the very large run of salmon in the fall of 1888, and the absence of the usual demand from the cannery, there was a large surplus of fish pickled and packed in barrels, this being the only available means of saving them. There was but little time to handle the large catch, and the haste with which the salmon were cured resulted in the preparation of a somewhat inferior article, for which little demand could be found in the market, and in consequence the packers did not receive the remuneration which might have been expected from a season of abundance.

A salmon cannery was established at Eel River in 1877, but this was not in operation in 1888. The employés of the cannery when in operation were Chinese. There are fish enough in the river to maintain a cannery in active operation during the season. The fishermen have considerable difficulty in disposing of all their catch if, for any reason, the cannery fails to open.

Markets and shipments.—About three-quarters of the fresh fish taken in Humboldt County are sent to San Francisco by steamer from Eureka and Field's Landing. The pickled fish, in barrels, also find a market in that city. The monthly shipments of fresh salmon and flounders and the prices generally received are shown in the following table:

Shipments.			Prices.	
Months.	Salmon.	Flounders.	Kinds.	Per pound.
	Lbs.	*Lbs.*		*Cents.*
January	120,000	4,000	Fresh salmon, locally	5
February	34,000		Fresh salmon, shipped	[illegible]
March	3,700		Fresh flounders, shipped	[illegible]
October	88,500	4,000	Other fresh fish, locally	5
November	232,100	10,000	Clams, locally	1½
December	140,000	2,000	Pickled salmon, shipped ($6 per bbl.)	3
Total	632,300	20,000		

The condensed statistics of the fisheries of this country in 1888 are as follows:

Persons employed.

Country.	Nativity.	Nationality.
United States	75	105
United States (Indians)	26	26
Portugal	102	[illegible]
Italy	35	[illegible]
Sweden	33	[illegible]
Russia	21	21
Total	[illegible]	[illegible]

Apparatus and capital.

Designation.	No.	Value.
Boats	[illegible]	$1,[illegible]
Haul seines	16	4,[illegible]
Gill nets for salmon	117	7,100
Gill nets for perch and flounders	10	250
Shore property		1,500
Cash capital		2,500
Total		18,010

Products and values.

Species.	Pounds.	Value.
Salmon, fresh	747,200	$18,[illegible]
Salmon, pickled	215,000	8,400
Flounders, fresh	20,000	600
Shad, fresh	400	40
Other fish, fresh	41,500	2,075
Clams	72,000	1,200
Total	1,106,100	31,[illegible]

24. FISHERIES OF DEL NORTE COUNTY.

Geographical characteristics.—This is the northernmost shore county of the State. It has a short coast line, which, north of the center, is interrupted by Pelican Bay. There are two rivers in which all the fishing of the county is done: Smith River, which enters the Pacific Ocean just north of Pelican Bay, and the Klamath River, which forms the boundary between this and Humboldt County on the south. Smith River rises in the northeastern part of Del Norte County and flows thence in a westerly direction to the Pacific Ocean. The Klamath River issues from the lower Klamath Lake, in Klamath County, Oregon, and runs southwesterly across Siskiyou County, passes through the southeastern section of Del Norte County, keeping its southerly course into Humboldt County, where it forms a juncture with the Trinity River, whence its course is directed to the northwest until it reaches the Pacific Ocean. Near the mouth of the Klamath River is an Indian reservation. The Indians are extensively engaged in fishing for the salmon cannery at the Indian town of Requa.

Importance of fisheries.—The fisheries of Del Norte County supply salmon for the canneries on the Klamath and Smith Rivers. In 1888 there were but two canneries. The one at Requa, on the Klamath, was built in 1888; the one on Smith River was established a number of years previous. The pack in 1888 was light, aggregating only 6,747 cases, valued at $43,012, this representing 440,755 pounds of fish as taken from the water, or 324,856 pounds as canned.

Species, seasons, etc.—Salmon is the only object of the fisheries in Del Norte County. There is only a spring run of this species in Smith River. The Klamath River is important as a salmon stream because it is one of the four rivers on the Pacific coast which has both a spring and fall run, and also on account of the quality and abundance of the species. Salmon make their appearance as early as April, but the run does not become general until May; it lasts until about October; the fall migration begins about September 15 and lasts until November 15. Fishing is carried on only near the mouth of the river because of the falls about 3 miles above.

Apparatus, boats, etc.—Gill nets are generally used to capture salmon. In 1888 there were 60 nets in use, the average length being 300 feet, the nets having a value of from $60 to $80 each. Two seines were used on the Smith River. The boats used on the Smith and Klamath Rivers are small skiffs and Indian canoes.

Disposition of products.—The fish taken on Smith River were utilized at the cannery near the mouth of that stream. The salmon caught on the Klamath River were sold for canning purposes at 5 cents per pound; 70,000 pounds more were shipped to Rogue River, Oregon, and there packed. The Indians on the Klamath also captured large quantities of fish, chiefly for home consumption, a considerable quantity being cured for winter use.

The following tables show the principal phases of the fisheries:

Persons employed.

Country.	Fishermen.		Factorymen.	
	Nativity.	Nationality.	Nativity.	Nationality.
United States	15	19	11	11
United States (Indians)	42	42	33	33
Sweden	6	3		
France	4	4		
Great Britain	3	2		
China			2	2
Total	70	70	46	46

Apparatus and capital.

Designation.	No.	Value.
Boats	[illegible]	$2,150
Seines	2	200
Gill nets	60	[illegible]
Factory and accessories		12,000
Cash capital		10,000
Total		[illegible]

Products and value.

Species.	Pounds.	Value.
Salmon, fresh	*[illegible]	[illegible]
Salmon, salted	[illegible]	[illegible]
Total	[illegible]	[illegible]

*This includes 70,000 pounds sold by fishermen of Requa to cannery on Rogue River, Oregon.

III.—THE FISHERIES OF OREGON.

25. GENERAL REMARKS.

Oregon ranks next to California in the extent and value of its fisheries. The State has no vessels employed in fishing,* but its shore salmon fishery is of vast extent, that in the Columbia River surpassing in magnitude any other stream on the globe. In the importance of its salmon-canning interests Oregon takes first place, the output of canned goods in 1888 amounting to nearly $2,000,000. The extent of the salmon-canning industry in 1888 is shown in detail in the accompanying statement:

The salmon-canning industry of Oregon in 1888.

Location of canneries.	No. of canneries.	No. of factory hands.	Salmon used for canning.		Canned salmon placed on market.	
			Pounds.	Price paid fishermen.	Cases.	Value.
Rogue River	1	106	1,474,840	$29,457	21,062	$121,107
Coquille River	2	40	770,000	11,550	11,000	63,250
Coos Bay and River	1	46	385,000	5,775	5,500	31,625
Umpqua River	1	51	675,000	13,500	9,000	51,750
Siuslaw River	1	45	837,200	12,558	11,960	68,770
Alsea River	3	65	673,400	10,101	9,620	55,315
Yaquina River	3	61	352,344	10,570	5,033	28,[illegible]
Nestuggah River	1	33	350,000	5,250	5,000	28,750
Tillamook River	2	87	1,074,310	21,286	14,633	84,140
Nescoxin Creek	1	8	28,000	420	400	2,300
Columbia River	18	1,007	14,771,054	708,328	227,559	1,305,354
Total	34	1,564	21,390,648	869,772	328,622	1,901,817

The following tables give the figures of persons employed, apparatus, and products for each stream that maintains commercial fisheries:

Persons employed in the fisheries of Oregon in 1888.

Streams.	Fishermen on vessels.	Fishermen on boats.	Shoresmen.	Total.
Windchuck River	....	2	....	2
Chetco River	....	30	....	30
Rogue River	18	41	106	165
Elk River	....	5	....	5
Sixes River	....	7	....	7
Coquille River	....	184	40	224
Coos Bay and River	4	58	46	108
Umpqua River	....	38	51	89
Siuslaw River	....	136	45	181
Alsea River	....	92	65	157
Yaquina River	....	78	61	139
Nestuggah River	....	30	38	68
Tillamook River	....	154	87	241
Nescoxin Creek	....	6	8	14
Columbia River	31	2,134	1,007	3,172
Willamette River	....	90	....	90
Total	53	3,043	1,564	4,[illegible]

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* No vessels were actually engaged in catching fish in 1888, but a few small steamers and sailing vessels were employed in connection with the canneries.

Nativity and nationality of persons employed in the fisheries of Oregon in 1888.

Country.	Vessels.		Boats.		Shore.		Total.	
	Nativity.	Nationality.	Nativity.	Nationality.	Nativity.	Nationality.	Nativity.	Nationality.
United States	32	44	[illegible]	2,075	174	231	[illegible]	2,350
United States (Indians)			106	108	1	1	107	109
British Provinces	3	1	68	10	16	5	87	16
Sweden	14	6	735	109	21	5	770	120
Norway			[illegible]	85			[illegible]	85
Denmark			9				9	
Germany	2		64	26	11		77	26
Greece			86	23			86	23
Italy			94	79	1		95	79
Russia			610	297	6	2	616	299
Austria			284	181	3	1	287	182
Portugal			45	26	2	2	47	28
France			6	6			6	6
China	2	2	10	10	1,347	1,347	1,359	1,359
Africa			1				1	
Total	53	53	3,045	3,045	1,584	1,584	4,682	4,682

Apparatus and capital employed in the fisheries of Oregon in 1888.

Streams.	Gill nets.		Seines.		Weirs and pound nets.		Salmon wheels.		Value of minor apparatus.
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	
Windchuck River			1	$250					
Chetco River			2	500					
Rogue River	123	$8,675	2	1,700					
Elk River	1	50	1	150					
Sikhs River	2	100	1	150					
Coquille River	150	9,000	9	1,600					
Koos Bay and River	134	6,930							
Umpquah River	45	6,200	1	500	2	$1,000			
Siuslaw River	68	5,100							
Alseya River	52	5,200	2	400					
Yaquina River	75	7,200	2	800	2	500			
Nestuggah River	15	1,125							
Tillamook River	109	9,925	2	400					
Necanicum Creek	6	300							
Columbia River	1,578	262,725	3	1,050	52	40,050	24	$65,613	$2,900
Willamette River	190	5,000							
Total	2,548	322,620	25	7,500	56	41,550	24	65,613	2,900

Streams.	Vessels.				Boats.		Other property.		Total capital invested.
	No.	Tonnage.	Value.	Value of outfit.	No.	Value.	Land, buildings, etc.	Cash capital.	
Windchuck River					2	$100			$350
Chetco River					4	200			700
Rogue River	3	*190.58	$26,600	$1,500	25	1,300	$40,000	$60,000	134,175
Elk River					1	25			225
Sikhs River					2	175			425
Coquille River					54	2,540	16,500	45,000	75,140
Koos Bay and River	1	85.87	7,500	2,000	42	2,980	20,000	26,000	65,410
Umpquah River					39	2,025	12,000	25,000	45,725
Siuslaw River					68	2,300	12,000	25,000	44,400
Alseya River					43	1,300	9,550	28,000	44,450
Yaquina River					73	3,000	10,000	20,350	41,850
Nestuggah River					15	450	12,000	20,000	33,575
Tillamook River					78	11,200	22,600	40,000	84,125
Necanicum Creek					3	225	600	1,500	2,625
Columbia River	9	145.85	40,550	7,900	1,025	169,885	463,894	555,000	1,707,287
Willamette River					40	800			5,800
Total	13	422.30	74,650	11,400	1,545	201,085	610,294	802,850	2,296,685

* Tonnage partly estimated.

Products of the fisheries of Oregon in 1888.

Streams.	Fish sold fresh.				Fish salted.				Value of mollusks, crustaceans, and secondary products.	Total value of products.
	Salmon.		Other species.		Salmon.		Other species.			
	Pounds.	Value.	Pounds.	Value.	Lbs.	Value.	Lbs.	Value.		
Windchuck River					16,000	$640				$640
Chetco River	30,000	$450			73,000	2,920				3,370
Rogue River	1,554,240	31,837								31,837
Elk River	26,000	390			10,000	400				790
Sixes River	20,000	300			12,000	480				780
Coquille River	734,000	10,800			15,000	600				11,400
Coos Bay and River	745,000	12,975								12,975
Umpquah River	675,000	13,500			72,000	2,880				16,380
Siuslaw River	837,200	12,558								12,558
Alseya River	812,400	12,901								12,901
Yaquina River	900,150	15,005							$6,250	21,255
Siletz River	108,764	3,029								3,029
Nestuggah River	350,000	5,250								5,250
Tillamook River	1,074,310	21,236								21,236
Necanicum Creek	28,000	420								420
Columbia River	15,086,460	811,481	1,019,924	$21,158	327,900	13,316	191,200	$3,974	16,481	866,410
Willamette River	228,600	11,430			7,000	280	10,000	500		12,210
Total	22,415,242	963,616	1,019,924	21,158	532,900	21,596	201,200	4,474	22,731	1,033,574

26. FISHERIES OF THE WINDCHUCK RIVER.

Windchuck River is the southernmost stream in Curry County, Oregon, being located very near the California state-line. It traverses the county for a distance of about 25 miles before reaching the Pacific.

There is only a fall run of salmon. The fishing begins about the middle of September and lasts until the end of November. Several species of salmon are found in this stream—quinnat, silver, steelhead, and blueback. As a rule, bluebacks enter the river after all other species; at times as many as 600 have been taken at one haul of the small seine used on this river. There is no fishery for other species than the salmon, and this is of little consequence, as will be seen by the following statistics for 1888:

Persons employed (nativity and nationality):	
United States	3
Apparatus and value:	
1 seine	$250
2 boats	100
Products and value:	
80 barrels salted salmon	640

27. FISHERIES OF THE CHETCO RIVER.

Chetco River empties into the Pacific a few miles north of the California line, in Curry County, and about 24 miles south from Rogue River; it rises at the base of the Red Peak mountains, in the southern part of Curry County, and flows a distance of about 20 miles to the

Report U. S. F. C. 1888.—(To face page 179.) Pacific Coast Fisheries. PLATE XXIII.

SEINING SALMON ON ROGUE RIVER.

ocean. Its fisheries are insignificant, as shown by the table, employing only 30 men in 1888. The fresh salmon shown in the table were sold to a cannery located on Smith River, California.

Persons employed (nativity and nationality):	
United States	15
United States Indians	15
Apparatus and value:	
2 seines	$500
4 boats	200
Products and value:	
365 barrels salt salmon	2,920
30,000 pounds fresh salmon	450

28. FISHERIES OF THE ROGUE RIVER.

Rogue River issues from Crater Lake, in the Cascade range of mountains, on the western border of Klamath County, Oregon, flowing a distance of about 325 miles to the ocean, which it enters at Ellensburgh.

Fishing centers.—The town of Ellensburgh, located near the mouth of the river, is the only center for fisheries. A salmon cannery is located here. The town is entirely dependent upon the fisheries, its inhabitants being employed more or less in this vocation. In every respect it may be called an "industrial town," being founded and maintained through the influence of the fisheries.

Importance of the fisheries.—The salmon fishery of Rogue River ranks third in importance among the river fisheries of the west coast, there being both a spring and fall run of salmon. Fishing is not prosecuted for other species. For many years prior to the establishment of the cannery at Ellensburgh a large amount of salmon was caught and pickled in barrels, but overfishing and the effects of hydraulic mining rendered the industry of little importance until artificial propagation was begun. From the time that the effects of successful artificial propagation were felt the catch and pack of salmon show an annual increase.

The following is a statement of the number of cases of salmon of the spring and fall runs which were packed during the years 1877 to 1889:

Year.	Spring cases.	Fall cases.	Total number of cases.	Year.	Spring cases.	Fall cases.	Total number of cases.
1877	3,197	4,607	7,804	1884	8,202	4,174	12,376
1878	2,402	6,497	8,894	1885	5,442	3,968	9,410
1879	4,048	4,523	8,571	1886	4,299	7,848	12,147
1880	4,142	3,630	7,773	1887*	7,290	9,926	17,216
1881	8,303	4,017	12,320	1888†	13,633	7,460	21,093
1882	15,088	4,098	19,186	1889‡	16,156		
1883	10,837	5,310	16,136				

*2,000 cases of the fall pack were made from salmon taken in Klamath River.
†1,000 cases of the fall pack were canned from salmon caught on the Klamath.
‡The report for 1889 was brought up to August 29, when the fall pack had just commenced. The cannery was closed but 10 days between the ending of the spring pack and opening of the fall pack.

The first attempt at artificial propagation was made in 1878, but on account of inexperience and lack of proper facilities little or no success was met with until 1882. It will be noticed that the pack of 1885 was exceptionally low. This result is attributed to the fact that 4 years previously nearly all the spawners that had been held in confinement died, and consequently eggs could not be secured in any numbers. In 1886 the effect of the successful hatching of several hundred thousands of young salmon in 1882 was felt, and from this time on there has been a marked annual increase of important proportions.

It may not be out of place to notice in a brief manner the establishment of Mr. R. D. Hume on this river. Settling on the river with only a wilderness surrounding him, he has, by his indomitable energy, through the medium of the fisheries, built up one of the most complete establishments on the Pacific. In connection with the enterprise has sprung up the small town of Ellensburgh. Mr. Hume's establishment embraces all that pertains to the salmon fishery. There is a cannery for the packing of salmon; sailing vessels and a steamer for transporting the products to market; a hatching establishment and rearing ponds for the propagation of salmon; nets are made here, boats and sails manufactured, the fishermen housed and boarded; a general store, including a medical dispensary, etc., supplies all necessary wants.*

Species, seasons, etc.—There are three varieties of salmon found in the Rogue River, the quinnat, silver, and steelhead;† also the salmon trout, black-spotted trout, sole, sardine, smelt, herring, perch, suckers, lamprey eels, etc. The salmon are the only objects of fisheries, except perhaps the trout, which are sought by anglers more as a pastime than for commercial purposes. The quinnat salmon is the first to enter the river; it arrives about March 1 and continues to run until October 1; a few scattering specimens occur after that date. Silver salmon appear about the middle of September and continue until about the middle of November, though a few may be taken before and after those dates. There is also a large run of steelheads in January and February, which continues into the spring. The average weight of salmon in the Rogue is said to be greater than that of the same species in the Columbia. Of two lots of quinnat salmon of twelve specimens each that were indiscriminately caught and weighed, the first lot averaged 33½ pounds and the second lot 24½ pounds, bringing the average to about 30 pounds. The silver salmon and steelhead average about 8 pounds each.

Fishing grounds.—The grounds upon which the fisheries are prosecuted are all located on the river. On the shores, near the mouth of the stream, seines are hauled, and gill nets and set nets are operated in the river, chiefly below the village.

Fishermen, wages, etc.—The fisheries on the river gave employment in 1888 to 32 Americans, 3 Englishmen, 4 Swedes, 1 Austrian, and 1 negro, making a total of 41 men. In addition, 18 men were employed on the transport vessels; these men are hired by the month and boarded. The pay varies with the position and character of work.

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* In another paper, in course of preparation by the Commissioner, more detailed notice will be taken of the propagating work done by Mr. Hume.

† The steelhead, though belonging to the river trouts, is universally called a salmon and for this reason the popular name is used in this report.

Boats and apparatus.—There are two schooners and a steam vessel employed in connection with the fisheries of Rogue River. These are used to market the products and carry the supplies to the town. The steamer *Thistle*, of 32.58 tons net register, is unique, inasmuch as it has two propellers on one shaft, one astern and one forward. It is claimed that this arrangement facilitates her progress when crossing the bar at the mouth of the river. The small boats used here are mostly of the flat-bottomed, sharpy type. Large flat-bottomed seine boats are used when setting the seine.

Drift nets are 60 to 75 fathoms long and 18 to 20 feet deep, though some have a length of 150 fathoms. The mesh is 8⅜ inches. Seines range from 140 to 250 fathoms in length, and are 22 feet deep, having a mesh from 3½ to 5 inches. Set nets are 12 to 25 fathoms long, 22 to 24 feet deep, and have an 8¾-inch mesh.

Methods of fishing.—The spring salmon are captured chiefly in drift and set nets near the mouth of the river. In the fall seines are fished; these have two sizes of mesh; from July to September a 5-inch mesh is used for the quinnat salmon, and from about the middle of September until the run of steelhead salmon is over, a 3½-inch mesh. There are no pound nets or weirs on the river.

Disposition of products.—The catch of the steelhead (*S. gairdneri*) is shipped fresh to the market at Portland, Oregon. Other species, however, are mostly utilized at the packing establishment for canning purposes, although a few are occasionally shipped to markets at San Francisco and elsewhere in a fresh state. The canned products are sent by steam and sailing vessels for disposition at San Francisco, etc.

Salmon canning.—In 1888 the canning establishment on the river employed 106 factory hands; utilized 1,404,340 pounds of fresh salmon, worth $28,087, and manufactured 21,062 cases, valued at $121,107.

Statistics.—The following tables show the statistics of the fisheries of Rogue River in 1888:

Persons employed.

Country.	Fishermen.		Shoresmen.	
	Nativity.	Nationality.	Nativity.	Nationality.
United States	35	52	39	82
United States (Indians)			1	1
British provinces	5	1	8	
Sweden	17	6	4	
Austria	1		1	
China			53	23
Africa	1			
Total	*59	59	106	106

* Including 18 persons employed on fishery transports.

Apparatus and capital.

Designation.	Number.	Value.
Vessels (tonnage, 190.58)	3	$20,000
Outfit		1,500
Boats	25	1,300
Seines	2	1,700
Gill nets	123	3,675
Shore property		46,000
Cash capital		60,000
Total		134,175

Products and values.

Species.	Pounds.	Value.
Salmon used for canning	1,404,346	$28,087
Salmon shipped fresh	150,000	3,750
Total	1,554,346	31,837

29. FISHERIES OF THE ELK RIVER.

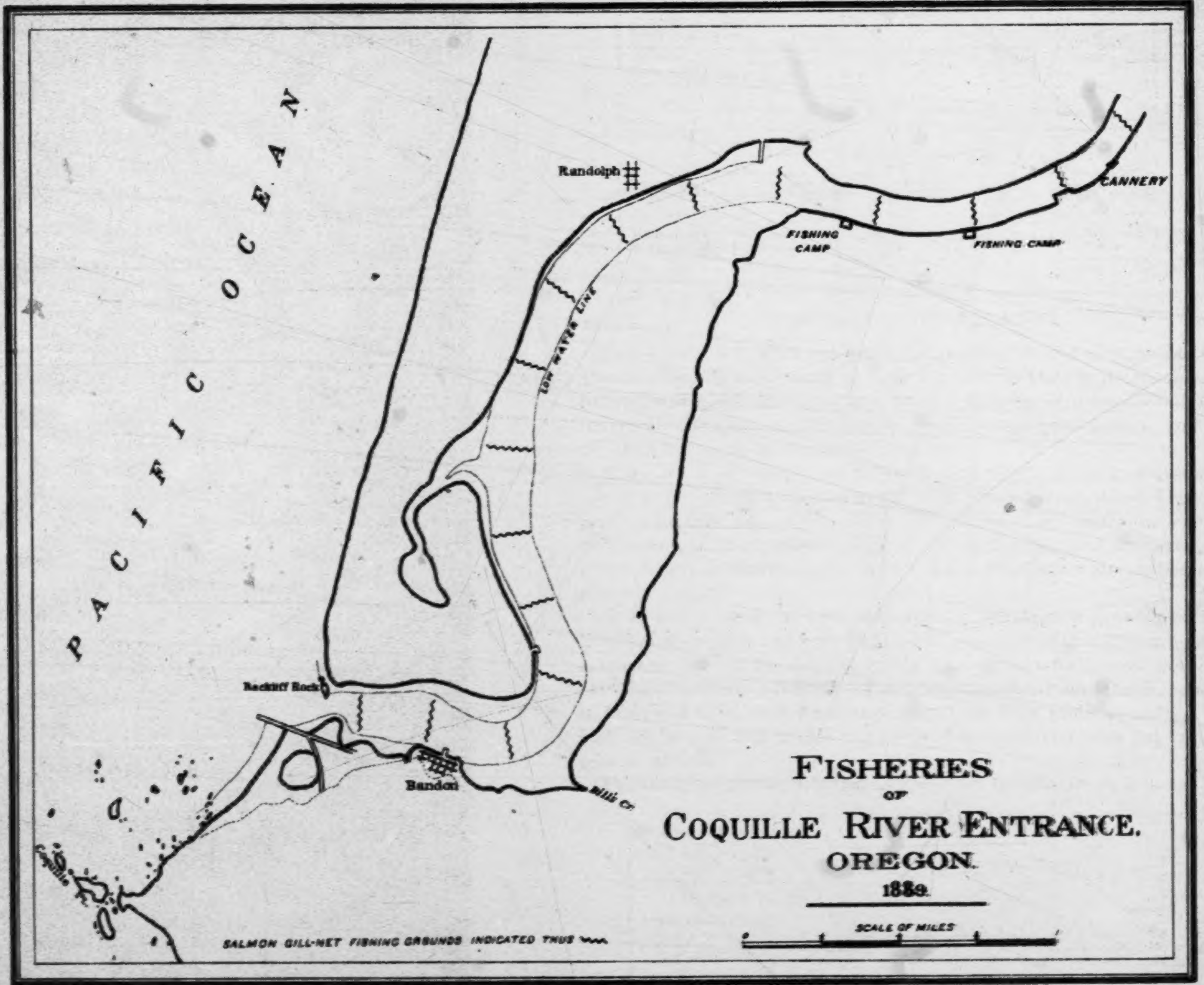
This stream is located in Curry County, Oregon, and empties into the Pacific about 2½ miles south of Cape Blanco. It rises in the mountains in the interior of the county and flows a distance of about 40 miles in a westerly direction to the Pacific Ocean. It is quite narrow, and its fisheries can never be of much importance.

Three kinds of salmon are taken in this river—chinook or quinnat, silver, and steelhead; salmon trout, black-spotted trout, smelt, herring, perch, flounders, and suckers occur, but are not of economic importance at the present time. Salmon appear only in the fall, and are taken, as a rule, from the mouth of the river to the head of tide water, a distance of about 1 mile.

Most of the catch of 1888 was sold to the salmon cannery on the Coquille River, and has been included in the pack of that stream. Such salmon as can not be shipped to the cannery in a fresh condition are salted and packed in barrels. The first shipment of that character was in 1880, and since then small shipments have been made annually. In 1887 180 barrels and in 1888 50 barrels of salted salmon were put up and sent to market.

The statistics of the fisheries on this river in 1888 are as follows:

Persons employed:	
By nativity—	
United States	4
British provinces	1
By nationality—	
United States	5
Apparatus and values:	
Boat	$25
Seine	150
Gill net	50
Products and values:	
25,000 pounds fresh salmon	500
10,000 pounds salted salmon	400


PACIFIC OCEAN
Randolph
CANNERY
FISHING CAMP
FISHING CAMP
LOW WATER LINE
Rackliff Rock
Bandon
Bills Cr.
SCALE OF MILES
0
1
SALMON GILL-NET FISHING GROUNDS INDICATED THUS

FISHERIES
OF
COQUILLE RIVER ENTRANCE.
OREGON.
1889.

30. FISHERIES OF THE SIKHS RIVER.

This is another of the small rivers, which are so numerous along the coast of Oregon. It is located in the northern part of Curry County, flowing a distance of about 40 miles and entering the Pacific 1¼ miles north of Cape Blanco.

Practically the same species of fish occur in the Sikhs as in the Elk River. The salmon run begins about October 1 and continues until December; the best catches are made between October 15 and November 15. The chinook salmon in this stream are large, averaging about 30 pounds. The silver salmon are also large for that species, averaging about 15 pounds.

The fishing grounds are, for the most part, at the mouth of the river and do not extend a great distance upstream. The products in 1887 were 225 barrels of salted salmon. In 1888, 20,000 pounds of fresh salmon were sold to the cannery on the Coquille River, and the remainder of the catch, amounting to 60 barrels, was salted.

The statistics of the fisheries of this river in 1888 are as follows:

Persons employed:	
By nativity—	
United States	6
British provinces	1
By nationality—	
United States	7
Apparatus and capital:	
2 boats	$175
3 gill nets	100
1 seine	150
Products and values:	
1887—Salted salmon, 45,000 pounds	1,800
1888—Fresh salmon, 20,000 pounds	200
Salted salmon, 12,000 pounds	480

31. FISHERIES OF THE COQUILLE RIVER.

Coquille River (called *Nessa-til-cut* by the Indians) is formed by three branches, called the North, Middle, and South Forks, which rise in the Umpquah Mountains. The "Forks" unite near Myrtle Point, the head of tide water, about 45 miles by river from the mouth of the stream, the distance by land being about 15 miles. It is a deep and sluggish stream, well timbered on its banks. There are no natural obstructions, such as rapids, falls, or dams, on the river to hinder the free passage of fish.

Origin and development of the fisheries.—The first salmon cannery constructed on the Coquille was erected in 1883, at Parkersburgh. In 1886 another was built at the same place, and the following year the town of Randolph was selected as a site for a third. Prior to the erection of the salmon canneries the catch at different places along the river was salted and packed in barrels. The earliest recorded instance of any considerable quantity being packed was in 1877, when 3,000 barrels of salmon were pickled and shipped to San Francisco. Since then, and until the construction of the first cannery, there was an annual shipment of about 3,000 barrels. At present the catch is nearly all disposed of to the canneries, but in case a surplus is obtained it is usually salted.

Fishing centers.—The principal distributing point is Bandon, whence all shipments to San Francisco, or up the coast, are made. At this point there is a wharf for steamboats, by means of which only is this place accessible. Fishing stations or camps are located along the river for a distance of about 8 miles above Bandon. At these camps the fish are collected, and either shipped fresh to the canneries, or salted, barreled, and sent to Bandon for shipment to San Francisco.

Importance of the fisheries.—The total capital invested in the fisheries on this river in 1888 was $75,140, including boats, seines, gill nets, canneries, horses, etc. There are three canneries on the river, but in 1888 only two were in operation. These employed 40 hands in all. The men engaged in catching fish for the canneries numbered 222. The products for 1887 amounted to $13,800, and in 1888 to $11,460, not including the value of fresh salmon purchased by the canners from the fishermen of adjacent streams.

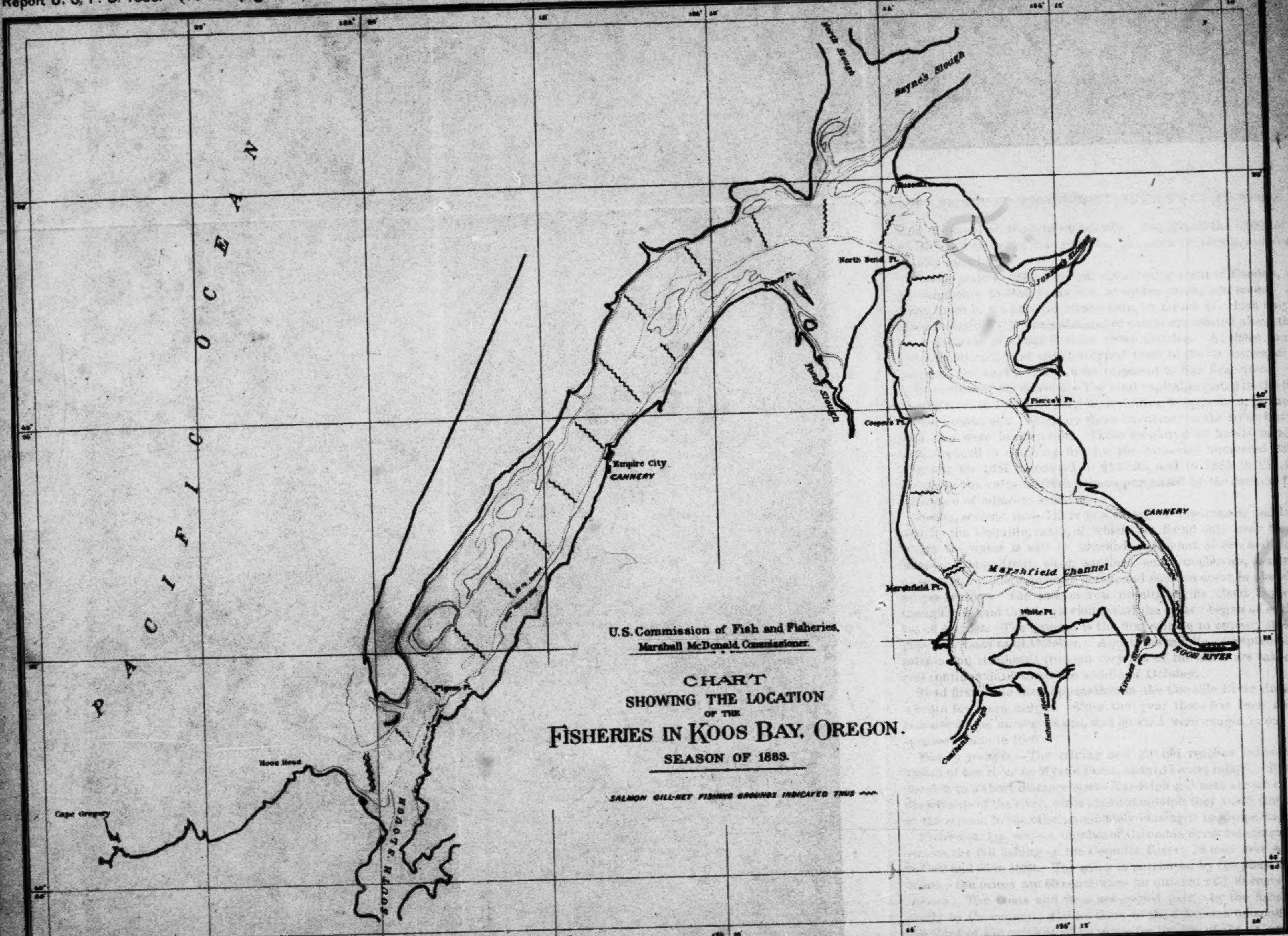
Species, seasons, etc.—There is a variety of anadromous and local species in the Coquille, many of which are found only near its mouth, where the water is salt or brackish. Quinnat, silver, and steelhead salmon, salmon trout, shad, sardines, smelt, anchovies, herring, sturgeon, sole, flounders, tomcod, perch, and suckers occur in abundance at proper seasons. The salmon run usually begins about September 1, though it is said that in previous years the season began as early as the 1st of August. The quinnat is the first salmon to appear, and the run generally lasts until October. About the middle of September silver salmon and steelheads (though very few of the latter are taken) arrive and continue until about the middle of October.

Shad first made their appearance in the Coquille River during 1884, when a few were caught. Since that year there has been an annual increase in the number taken, and 30 shad were caught in one haul of a salmon seine in 1889.

Fishing grounds.—The seining and gill net reaches extend from the mouth of the river to Myrtle Point, about 45 miles inland. From below Bandon to a short distance above Randolph gill nets are set entirely on the left side of the river, while above Randolph they reach from one side of the stream to the other, completely closing it to the passage of fish.

Fishermen, lay, etc.—A number of Columbia River fishermen annually pursue the fall fishing on the Coquille River; 38 men were so engaged in 1888 and 55 in 1889. The catch is purchased by the piece at the canneries; the prices are 60 cents each for quinnat and 40 cents for silver salmon. The boats and nets are owned partly by the fishermen and partly by the canners, who let them to the fishermen on condition that one-third of the catch shall be given for the use of the apparatus.

Boats and apparatus.—The boats are all flat-bottomed "skiffs," with


PACIFIC OCEAN
North Slough
Haynes's Slough
North Bend Pt.
Jordan's Slough
Pony Pt.
Pony Slough
Pierce's Pt.
Cooper's Pt.
Empire City
CANNERY
CANNERY
Marshfield Channel
Marshfield Pt.
White Pt.
KOOS RIVER
Kitchen Slough
Isthmus Slough
Coalbank Slough
Koos Head
Cape Gregory
SOUTH SLOUGH

U.S. Commission of Fish and Fisheries.
Marshall McDonald, Commissioner.

CHART
SHOWING THE LOCATION
OF THE
FISHERIES IN KOOS BAY, OREGON.
SEASON OF 1888.

SALMON GILL-NET FISHING GROUNDS INDICATED THUS ~~~

sharp bow and square stern, and average from 18 to 20 feet in length, having about 5 feet beam.

The gill nets are 70 fathoms long and 16 to 17 feet deep, with a 7¼ to 8¼ inch mesh. The seines average from 130 to 140 fathoms long, 18 to 20 feet deep, the mesh being 4½ inches in the bunt and 5 inches in the wings. Seines and gill nets are made by the fishermen.

The statistics of the fisheries in this river in 1888 are as follows:

Persons employed.

Country.	Fishermen.*		Factorymen.	
	Nativity.	Nationality.	Nativity.	Nationality.
United States	36	117	4	4
Sweden	75	32		
Norway	50	27		
Russia	60	45		
Portugal	1	1		
China			36	36
Total	222	222	40	40

*Of these, 18 were from the Columbia River and are reported from there.

Apparatus and capital.

Designation.	No.	Value.
Boats	84	$2,340
Gill nets	156	9,000
Seines	8	1,800
Buildings, machinery, etc		15,000
Cash capital		45,000
Total		73,140

Products and values.

Species.	1887.		1888.	
	Pounds.	Value.	Pounds.	Value.
Salmon, fresh	540,000	$12,600	734,000*	$10,800
Salmon, salt	30,000	1,200	15,000	600
Total	570,000	13,800	749,000	11,400

* This quantity, together with the fish purchased from outside fishermen, was utilized in the manufacture of 11,000 cases of canned salmon, valued at $52,250.

32. FISHERIES OF KOOS BAY AND RIVER.

Koos River proper is an unimportant stream. Rising in Koos County, at the base of the Umpquah Mountains, it flows in a northwesterly direction for a few miles, and empties into what is known as Koos Bay, a navigable inlet of the ocean, having numerous arms or branches. Koos Bay, after being joined by Koos River, describes almost a semicircle, its course lying in a northwesterly direction for about half the distance, whence it turns, almost abruptly, to the southwest, until it reaches the ocean. There is much marshy ground in the bay, and a number of so-called sloughs, or small creeks, which empty into the bay from both sides. Taking the left side of the bay at the point where it is joined by the river, and passing around its shore, there are Kitchen Slough, Isthmus Slough, and Coalbank Slough, all of which are directly west of the mouth of Koos River. Leaving the last-named slough, the shore line trends to the north until North Point is reached, a sort of peninsula jutting out into the bay. Here Poney Slough enters the bay and the shore line takes a decided bend to the southwest; near the point where the bay enters the ocean it is joined by South Slough. On the right bank Jordan's Slough, Haynes's Slough, and North Slough enter the bay, the latter being its northernmost arm.

Importance of the fisheries.—The fisheries here are of minor importance, employing 90 fishermen, 46 persons in canneries, $61,410 capital, and producing 1,041,000 pounds of fresh salmon in 1887 and 745,000 pounds in 1888, worth (at the prices paid the fishermen), respectively, $16,365 and $12,975.

Species, seasons, etc.—Quinnat, silver, and steelhead salmon, salmon trout, herring, smelt, sardines, rockfish, perch, sturgeon, tomcod, sole, and flounders are found in the bay, but only the salmon are sought for capture. Salmon are most abundant from the middle of August until November. The quinnat is the first to appear, and is quite numerous until about the middle of September. The season for the silver salmon is between September 15 and October 15.

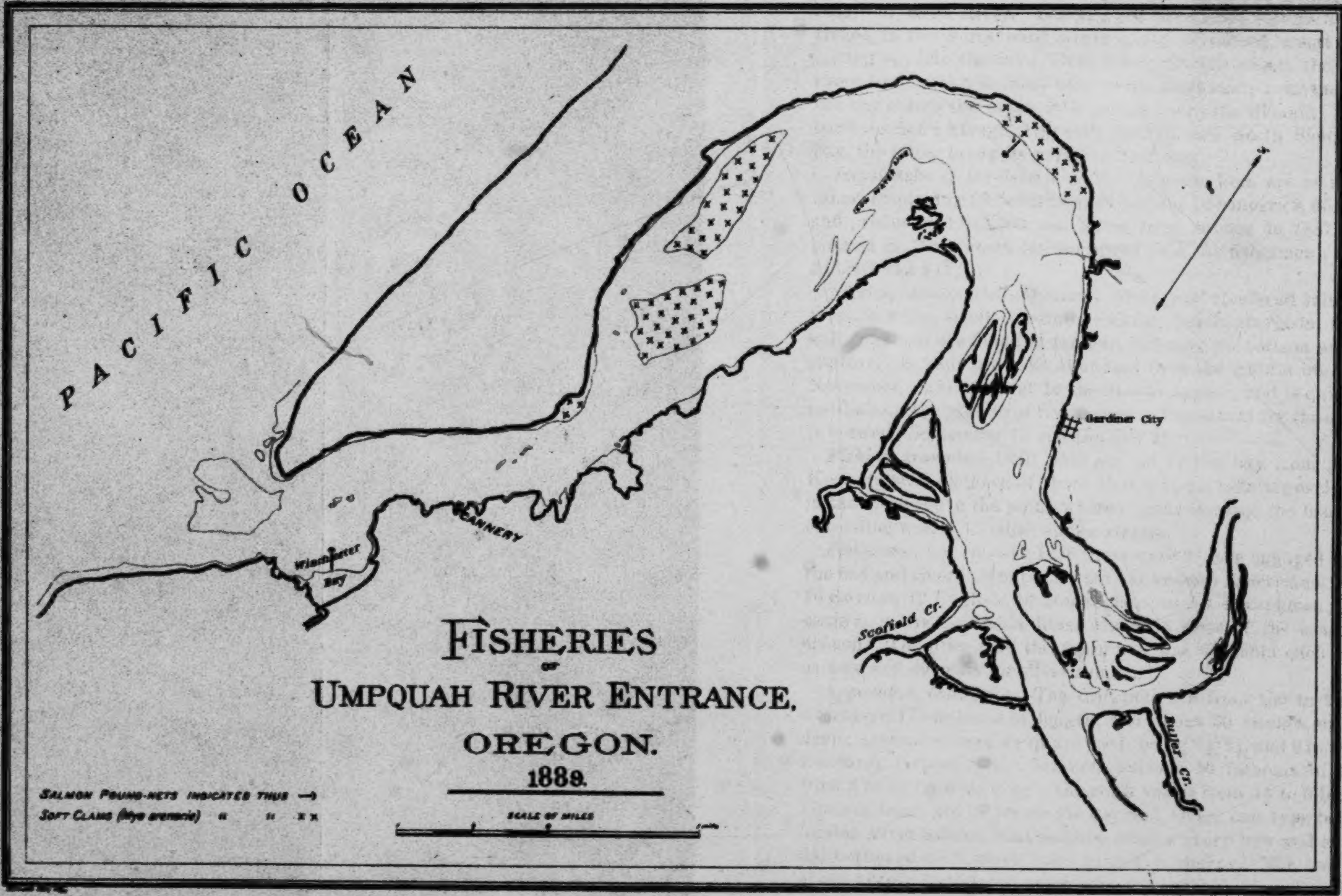
Fishing grounds.—Drift nets are set in the bay from its mouth to Koos River, a distance of about 15 miles; set nets are exclusively used in the river above the point where it joins the bay, the fishing grounds extending nearly 12 miles up the stream.

Fishermen, lay, etc.—In 1888 there were 90 men engaged in fishing on the bay and river; 28 of them were native-born Americans, 20 Russians, 16 Swedes, 12 English, 10 Norwegians, and 4 Frenchmen; 28 of them came from the Columbia River after the close of the season on that stream. The price paid the fishermen was 50 cents each for quinnat salmon and 30 cents for silver salmon.

Apparatus, boats, etc.—The drift nets are from 150 to 250 fathoms, averaging 175 fathoms in length, and about 30 meshes, or 3 fathoms, deep; several sizes of mesh are used, being 7½, 8½, and 9 inches (stretch measure), respectively. Set nets average 50 fathoms in length and from 3 to 4½ fathoms deep; the mesh varies from 7½ to 9 inches. Two kinds of boats are in use on the bay and river, one type being the Columbia River salmon boat and the other a sharp-bow and square-stern, flat-bottomed craft, much like a bateau or sharpy. The two types are about evenly distributed among the fishermen.

Salmon canning.—There are two salmon-canning establishments on the bay; one is situated at Empire City, near the mouth of the bay; the second is near the mouth of the river. Both began operations in 1887, the output of products for that year being 11,300 cases of canned salmon.

PLATE XXVI.


PACIFIC OCEAN
CANNERY
Winchester Bay
Gardiner City
Scofield Cr.
Butler Cr.
FISHERIES OF UMPQUAH RIVER ENTRANCE. OREGON. 1889.
SALMON POUND-NETS INDICATED THUS →
SOFT CLAMS (Mya arenaria) " " x x
SCALE OF MILES

During 1888 but one cannery was in operation, the pack being 5,500 cases. The operations of this establishment gave employment to 46 factory hands in addition to the fishermen who supplied the raw products.

The following tables exhibit the condition of the fisheries in Koos Bay and River in 1888. For purposes of comparison, the yield in 1887 is also added.

Persons employed.

Country.	Fishermen.*		Factorymen.	
	Nativity.	Nationality.	Nativity.	Nationality.
United States	28	57	2	2
British Provinces	12	6	3	3
Russia	20	14	1	1
France	4	4		
Sweden	16	5		
Norway	10	4		
China			40	40
Total	90	90	46	46

*Of the fishermen, 28 came from the Columbia River after the close of the season on that stream. In the total tables for the State they have been included under that river, where they properly belong.

Apparatus and capital.

Designation.	No.	Value.
Steamer (tonnage, 85.87)	1	*$8,500
Boats	42	2,900
Drift nets	26	3,090
Set nets	108	4,920
Shore property		20,000
Cash capital		24,000
Total		63,410

* Including outfits, provisions, fuel, etc.

Products and values.

Species.	1887.		1888.	
	Pounds.	Value.	Pounds.	Value.
Salmon sold to canneries	791,000	$11,865	385,000	$5,775
Salmon sold in local market	250,000	5,000	360,000	7,200
Total	1,041,000	16,865	745,000	12,975

33. FISHERIES OF THE UMPQUAH RIVER.

With the exception of the Columbia this is the longest and largest river in Oregon. It is formed by north and south forks, which rise in the eastern part of Douglas County, emanating from melting snows and mountain springs. The forks unite about 9 miles northwest of Roseburgh, and the river then flows northwestward through a fertile valley and enters the Pacific about 22 miles north of Empire City.

Species, seasons, etc.—The most important species in this river are the three varieties of salmon—quinnat, silver, and steelhead. Salmon trout, black-spotted trout, shad, herring, smelt (two species), tomcod, perch, flounders, and sole are also found here, all but the first three in salt or brackish water near the river's mouth. Salmon trout and black-spotted trout are plentiful in the upper river, though there is little or no fishing for them.

Shad have made their appearance in this stream, but only a few have been caught. The first catch was in 1888, when 13 were taken at one haul in a salmon net.

Three species of clams are found here—the razor clam, hard-shell clam (*Tapes* [*Cuneus*] *staminea*), and the soft-shell clam (*Mya arenaria*). These abound both on the sea beaches and inside the mouth of the river. However, the *Mya* is found more particularly in the latter-named location. It is claimed that the latter was transplanted to the Pacific in 1884 by Capt. Robert Simpson, who introduced it into this river as well as in Koos Bay. From all that can be learned it thrives in this locality and is becoming very abundant.

A few salmon enter the river in the spring, but never appear in large numbers at that season. Special attention is given to what is known as the "fall run," which begins about the first of August and continues until November. The quinnat is the first species caught, and it is numerous until about the middle of September; only a few are taken after that time. Silver salmon begin to arrive about the middle of September, and are caught as late as the middle of November, though the migration is at its height during October. The quinnat or chinook salmon of this river varies but little from that of the Columbia; the average weight is 25 pounds, some weighing 50 or 60 pounds.

Fishermen, lay, etc.—A large proportion of the fishermen are non-residents. As a rule they operate on the Columbia River until the close of the season, when they leave that locality and transfer their equipment to the Umpquah in sufficient time to get the large run of fish. During the season of 1888 the fishermen received from the canners 40 cents each for quinnat, and 25 cents each for silver salmon. The "lay" is the same as on the Columbia.

Apparatus, boats, etc.—Drift nets, set nets, drag seines, and pound nets are used. Drift nets have an average length of 175 fathoms, are about 2½ fathoms deep, and have a mesh varying from 7½ to 9½ inches. Set nets are from 100 to 150 fathoms long, about 30 meshes (2½ fathoms) deep, with mesh 7½ to 9½ inches. Seines are 250 fathoms long, 24 feet deep in the bunt, and 10 feet in the wings. All nets are made by the fishermen. The pound nets are similar to those on the Columbia.

The boats are mostly of the Columbia River type.

Methods of fishing.—Fishing is not commonly prosecuted during the daytime, except with pound nets; the water is generally much too clear for using gill nets, except at night; if, for any reason, the water is muddy, fishing with gill nets is continued during the day. The methods of operating pound nets and gill nets are similar to those employed on the Columbia.

Disposition of products.—Much good fish food obtainable on the Umpquah is not utilized on account of the lack of transportation facilities. The catch is now chiefly sold to the canners and the surplus salted and packed in barrels; but with quick transportation to some ready market, the fishermen would be able to realize a much greater profit than they now obtain. In 1888, 675,000 pounds of fresh salmon were used at the cannery, and 300 barrels of salted salmon were packed, the whole having a value of $16,380.

Salmon canning.—There are two canneries located on the Umpquah; one on an island opposite the town of Gardner, and the other about 1½ miles from the mouth of the river. The latter has not been in operation since 1884. The pack of the cannery near Gardner was 4,000 cases in 1887 and 9,000 cases in 1888.

The tables show the extent of the fisheries of this river in 1888:

Persons employed.

Country.	Fishermen.*		Factorymen.	
	Nativity.	Nationality.	Nativity.	Nationality.
United States	28	47	3	5
United States (Indians)	10	10		
Norway	2			
Germany	12	5		
Great Britain	2	2		
Sweden	14	6	2	
Russia	2	2		
Austria	6	4	1	1
Portugal	2	2	2	2
Italy	2	2		
China			43	43
Total	80	80	51	51

* The figures include 42 persons from the Columbia River, who are shown here to make the statistics complete, but are omitted in the general tables and included in the Columbia River statistics.

Apparatus and capital.

Designation.	No.	Value.
Boats	39	$2,925
Set nets	18	2,250
Drift nets	27	4,050
Drag seines	1	500
Pound nets	2	1,000
Building, machinery, etc.		15,000
Cash capital		25,000
Total		50,725

Products and values.

Species.	Quantity.	Value.
Salmon, fresh . . . pounds	675,000	$13,500
Salmon, pickled . . . do	72,000	2,880
Total	747,000	16,380

24. FISHERIES OF THE SIUSLAW RIVER.

The Siuslaw River has its source in the Umpquah Mountains in Lane County, Oregon. Its course lies first in a northwesterly direction and thence to the westward until the Pacific is reached. It is the dividing line of Lane and Douglas Counties. A sand bar at its mouth prevents navigation by all but light-draft vessels. The stream is navigable by such craft for 20 miles inland.

Importance of the fisheries.—The fisheries on this river are pursued for the sole purpose of supplying fish to salmon-canning establishments located upon it, which utilize the entire catch.

Species, abundance, etc.—There is a variety and an abundance of both anadromous and local species, though no attention is given to other than salmon, of which the quinnat and silver varieties occur. The season for salmon opens about the first of August and fishing is prosecuted until November, about which time the migration is completed.

Fishing grounds.—The salmon grounds extend from near the mouth of the river to about 20 miles up stream.

Salmon canning.—There are two factories located on the river, one at the town of Florence and the other a mile or so farther up the stream. In 1888 both these establishments united their interests, using the upper factory; the total output amounted to 11,900 cases of canned goods. During 1889 the arrangement of the previous year was observed, the cannery at Florence being operated.

The fisheries of this river in 1888 are given in the accompanying tables. The output in 1887 is added for purpose of comparison.

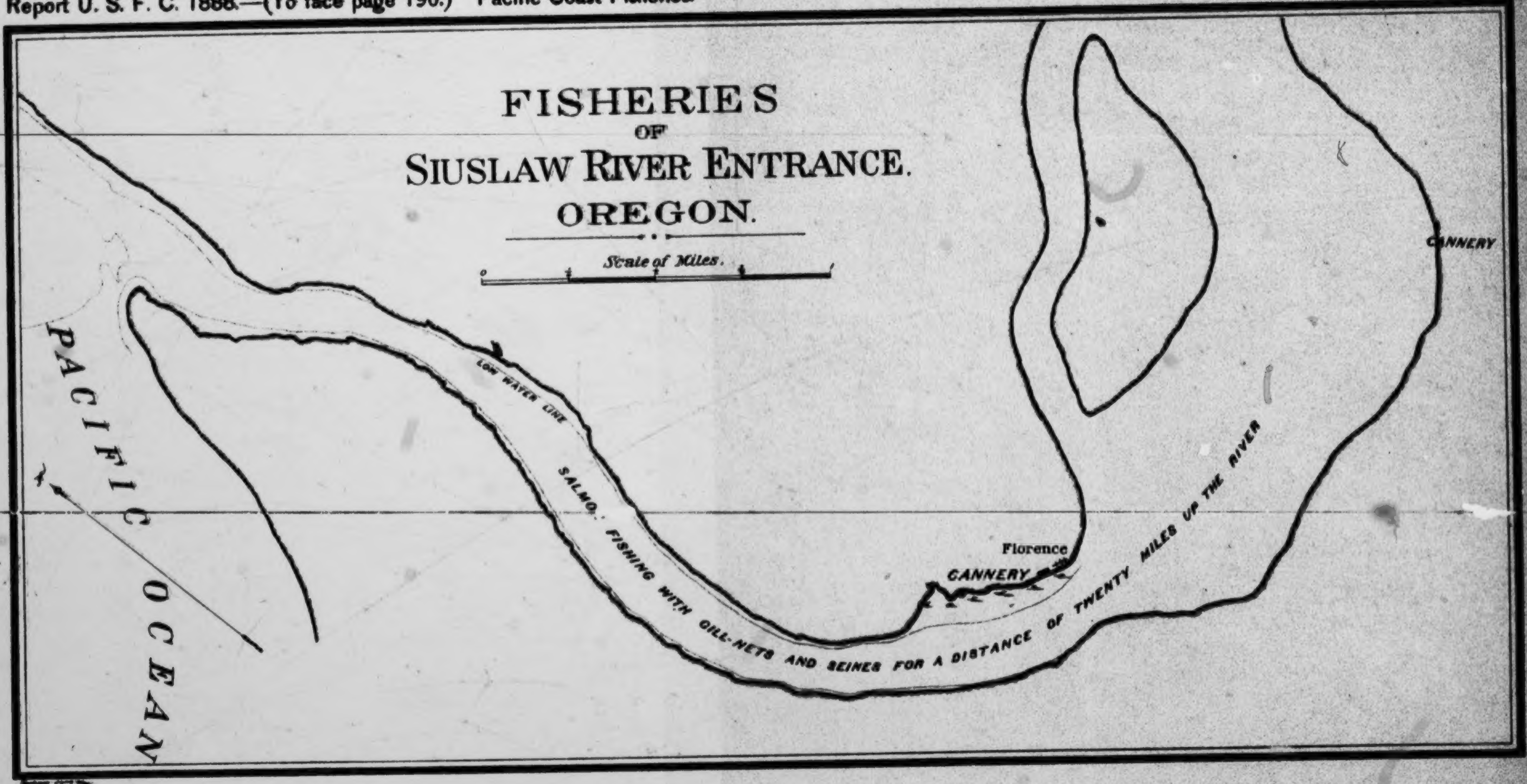
Persons employed.

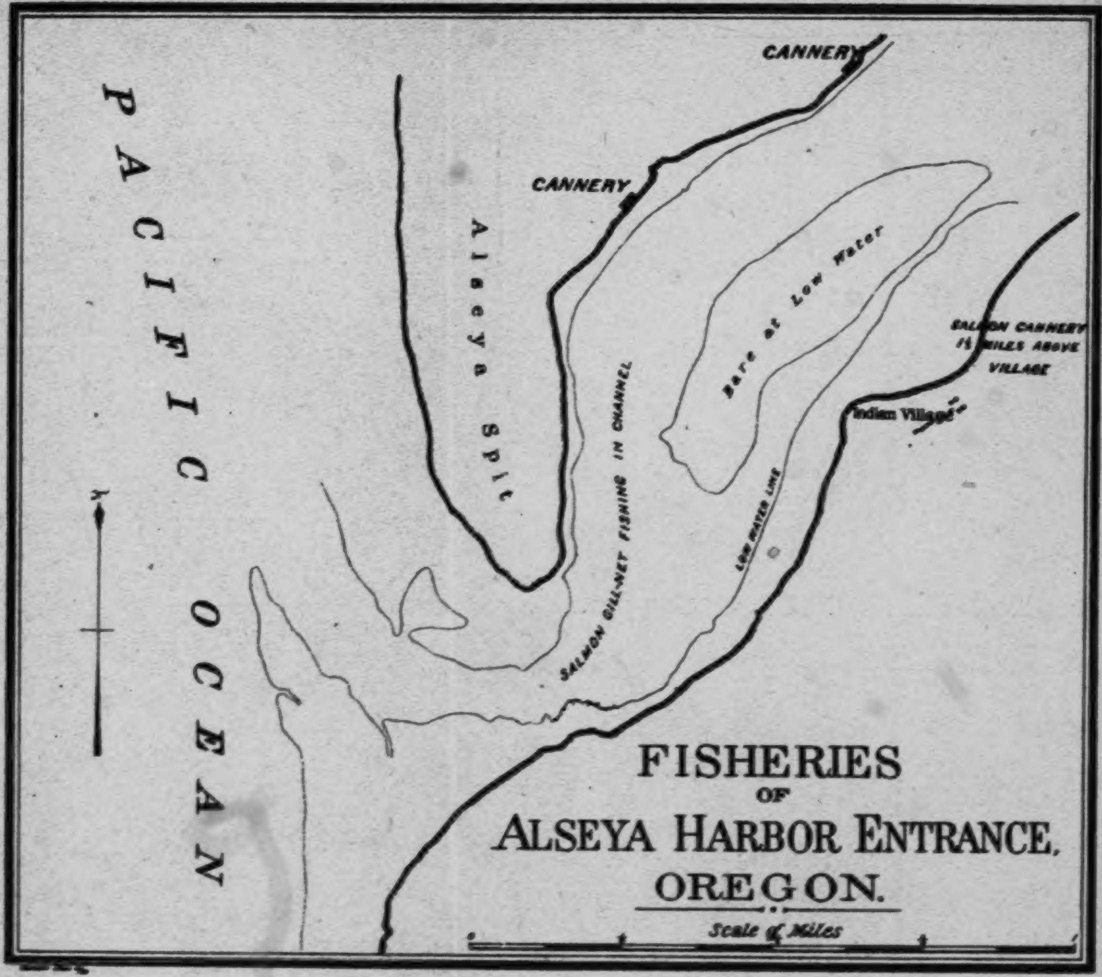
Country.	Fishermen.		Factorymen.	
	Nativity.	Nationality.	Nativity.	Nationality.
United States	72	104	4	4
Sweden	18	8		
Russia	22	14	1	1
Italy	2	2		
Germany	22	8		
China			40	40
Total	136	136	45	45

Apparatus and capital.

Designation.	No.	Value.
Boats	68	$2,300
Nets	68	5,100
Buildings, machinery, etc		12,000
Cash capital		25,000
Total		*44,400

* Not including one cannery temporarily idle in 1888, valued at $12,000.


FISHERIES
OF
SIUSLAW RIVER ENTRANCE.
OREGON.
Scale of Miles.
0
1
PACIFIC OCEAN
LOW WATER LINE
SALMO.: FISHING WITH GILL-NETS AND SEINES FOR A DISTANCE OF TWENTY MILES UP THE RIVER
Florence
CANNERY
CANNERY



FISHERIES
OF
ALSEYA HARBOR ENTRANCE,
OREGON.

PACIFIC OCEAN
Alseya Spit
CANNERY
CANNERY
Bare at Low Water
SALMON GILL-NET FISHING IN CHANNEL
LOW WATER LINE
SALMON CANNERY 1½ MILES ABOVE VILLAGE
Indian Village
Scale of Miles
0
¼
½
¾
1

Quantity and value of salmon.

Year.	Pounds.	Value.
1887	[illegible]	[illegible]
1888	[illegible]	[illegible]

36. FISHERIES OF THE ALSEYA RIVER.

Alseya River rises in the southwestern section of Benton County, Oregon, and flows in nearly a northwesterly direction to the Pacific, a distance of about 60 miles.

Importance of the fisheries.—Although this stream is of no great length, its salmon fisheries are quite important. In 1888 813,400 pounds of quinnat and silver salmon were caught, of which 673,400 pounds were utilized for canning purposes, and 140,000 pounds shipped fresh to interior markets. These products had a value of $12,901. The industry gave employment to 92 fishermen and 65 "hands" at the canneries.

Species, seasons, etc.—About the same species of fish occur here as in the Siuslaw and other small streams along the coast, but no fishery is prosecuted for other than the salmon. There are three varieties—quinnat, silver, and steelhead. The first two are most esteemed for canning purposes. There is no spring migration in this river; the fall run begins early in August and continues until about November. The quinnat comes first, followed by the silver salmon which appears about the first week in September. The largest catches are made between September 20 and October 20, when both species are in abundance. The average weight of the quinnat salmon on this river is 25 pounds, though single individuals weighing 60 pounds or more have been taken. Silver salmon average about 12 pounds each.

Fishing grounds.—The best grounds are from the mouth of the river to about 3 miles inland. Gill nets are fished in the channel near the entrance of the river as well as at other suitable localities. There are many places where sweep seines can be used.

Apparatus, boats, etc.—The drift nets are about 100 fathoms long, 3 fathoms deep, and have a 9½-inch mesh when used for quinnat salmon and 7½-inch mesh for silver salmon. Three haul seines are in use. Pound nets have been experimented with here, but, as was the case with those operated on the Yaquina River, their use was soon abandoned on account of the great quantities of grass which lodged in them and thus prevented the capture of salmon.

The boats are of the flat-bottomed batean type, sharp at the bow and having a square stern. They average 20 to 22 feet in length and have about 5½ feet beam.

Salmon canning.—There are three canneries located on the Alseya, two near its mouth and the third about 2 miles up the river. Salmon canning on this river was first undertaken in 1886; in 1887 two establishments were in operation, and three were worked during 1888, but two of them were small and packed only a limited number of cases. In 1887 the products of the canneries amounted to 11,180 cases, and in 1888 the three had a total output of only 9,280 cases. During 1888 the factories paid 50 cents for quinnat and 20 cents for silver salmon.

The fisheries on the Alseya River in 1888 were as follows:

Persons employed.

Country.	Fishermen.		Factorymen.	
	Nativity.	Nationality.	Nativity.	Nationality.
United States, white	56	73	10	16
United States, Indian	3	3		
United States, negro	3	2		
Italy	2	2		
Russia	3	3		
Sweden	11	5		
Norway	10	5		
Germany	4		6	
China			40	40
Total	92	93	56	56

Apparatus and capital.

Designation.	No.	Value.
Boats	43	$1,290
Gill nets	88	5,250
Seines	3	400
Shore property		2,500
Cash capital		35,000
Total		44,440

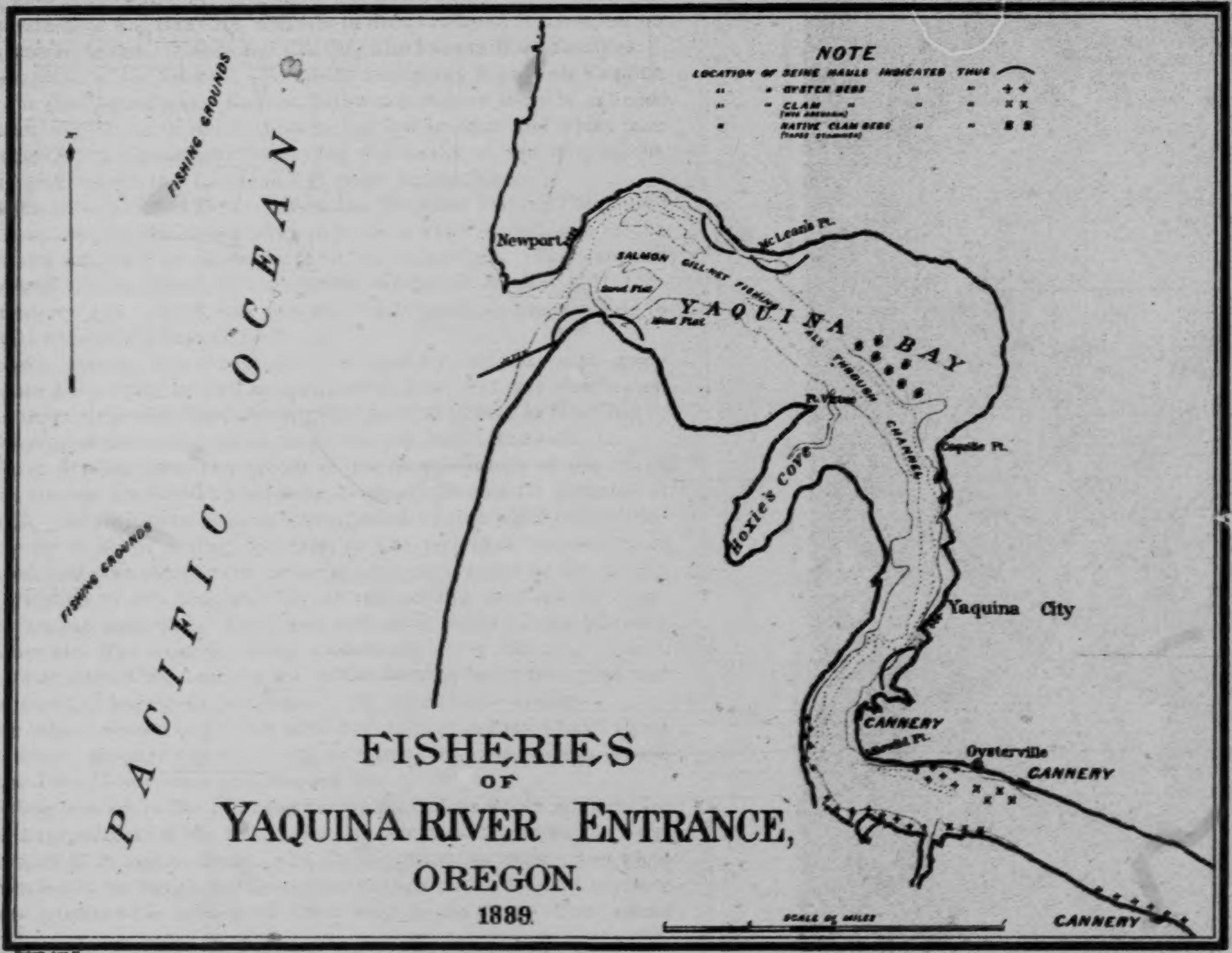
Products and values.

Species.	Pounds.	Value.
Salmon sold to canners	*672,400	$10,181
Salmon shipped fresh	140,000	2,800
Total	812,400	12,981

*Equivalent to 9,620 cases, with a value of $28,215.

36. FISHERIES OF YAQUINA BAY AND RIVER.

The Yaquina ("crooked") River is about 60 miles long; its general course is nearly west through the county of Benton. The river is narrow (from 30 to 40 yards wide) and comparatively unimportant for the greater part of its length. But a few miles from its mouth it suddenly broadens out into an estuary from one-half to three-fourths of a mile wide, which is commonly called Yaquina Bay. For many miles above the "bay" the river has a depth of between 12 and 15 feet, and is therefore navigable for vessels of considerable size. The river empties into the Pacific about 100 miles south of the Columbia. It is a stream



FISHERIES OF YAQUINA RIVER ENTRANCE, OREGON.

1889.

NOTE
LOCATION OF SEINE HAULS INDICATED THUS
" " OYSTER BEDS " " + +
" " CLAM " " " × ×
(MYA ARENARIA)
" NATIVE CLAM BEDS " " ● ●
(TAPES STAMINEA)
N
FISHING GROUNDS
FISHING GROUNDS
PACIFIC OCEAN
Newport
McLean's Pt.
SALMON GILL-NET FISHING ALL THROUGH CHANNEL
Sand Flat
Mud Flat
YAQUINA BAY
Pt. Virtue
Hoxie's Cove
Coquille Pt.
Yaquina City
CANNERY
Pt.
Oysterville
CANNERY
CANNERY
SCALE OF MILES

of some commercial importance and has a large lumber trade in addition to its fisheries.

Fishing centers.—The fishing centers are all in the lower section of the river and on the "bay." They are Oysterville, Yaquina City, Newport, Toledo, and Elk City. The most important shipping point for fishing products is Yaquina City, which is in direct railroad communication with interior towns. Toledo and Elk City also have railroad facilities.

Importance of the fisheries.—The most important fishery on Yaquina River is that for salmon. Besides the salmon fishery there is quite an industry carried on in native oysters. A few Indians and white men are engaged in a desultory fishery on the banks at sea outside the headlands, though this business is of minor proportions.

In the latter part of 1888 the "Yaquina Deep Sea Fishing Company" was incorporated, the object being to prosecute the sea fisheries off the coast and ship the products to the interior markets. The company purchased the auxiliary steam schooner *George H. Chance*, of 71 tons net register, and in 1889 was reported to be making preparations to actively engage in the business.*

Species, seasons, etc.—The river is bountifully supplied with many varieties of food-fish, as well as oysters and hard and soft shell clams. In addition to salmon the following species of fish occur in the "bay": Rockfish, flounders, sole, perch, bass, herring, smelt, and eels.

About 6 miles from the mouth of the river oysters of the small native species are found abundantly along the shores for a stretch of 4 miles. Atlantic oysters were transplanted to this place at one time and grew rapidly; owing, however, to the fact that but few were planted, and that these were taken up in a comparatively short time, the question of the practicability of successfully propagating them here remains unsettled. Hard and soft shell clams (*Tapes* [*Cuneus*] *staminea* and *Mya arenaria*) occur abundantly along the river shores. The latter species has been known in the locality but a few years and is supposed to have been introduced with the Atlantic oyster.

The salmon season begins the middle of August and lasts until about November. Oysters can not be taken during the close season, which begins June 15 and lasts until September.

Fishing grounds.—The principal fishing ground on which gill nets are used is the channel of the river from its mouth as far up as Elk City, a distance of 25 miles. Sometimes, during pleasant weather, and when the sea is not too rough, the fishermen venture out to sea and set their nets to intercept the salmon on their way to the river. Haul seines are operated at several places along the river. One reach is located just below the cannery on Idlewild Point, one on the east side and another on the west side of McLean's Point, on the north shore of the river, and two others almost directly opposite the latter place. Native clam (*Cancus*) beds are located on the flats just below Coquille Point, in the "bay." There are also several beds of oysters on both sides of the river near Oysterville, and the eastern clam (*Mya*) is abundant. The sea fishing grounds are located about a mile or so at sea from the harbor entrance. They are believed to be unimportant.

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*Since the above was written it has been learned that several untoward incidents or accidents, resulting chiefly from inexperience in sea fisheries, have led to the abandonment of this enterprise. The vessel and the headquarters of the company were transferred to Portland, Oregon, but lack of technical skill and of demand for fish militated against success. It is probable that the attempt to prosecute sea fishing from Portland will not be continued much longer.

Fishermen, lay, etc.—Seventy-eight men are engaged in the fisheries of this river. As a rule they follow the salmon fishery, though 20 of them engage in the oyster business at the proper season.

A number of the nets and boats are owned by the factory operators, in which case the fishermen receive but 2 cents per pound for all the salmon they take. Where fishermen own the nets and boats the factories buy the catch at the rate of 3 cents per pound.

Apparatus and boats.—The gill nets are from 100 to 125 fathoms in length, 16 feet deep, and have a mesh from 6½ to 9 inches, according to the kind of fish caught. The seines are, for the most part, made from old drift nets. A number of pound nets were put down in 1887, but on account of great quantities of grass fouling them few fish were caught, and their use was abandoned. During 1888 but one pound net and one wooden "trap" or weir were in operation.

The Columbia River salmon boat and the flat-bottomed bateau are used on the river.

Disposition of products.—Most of the salmon taken on the river are sold to the canneries, though a considerable quantity is shipped by express to the interior towns. The canneries purchased 352,344 pounds of salmon in 1888, and 147,806 pounds were forwarded by express in a fresh state.

The products of the oyster fishery are shipped by steamer to San Francisco and by rail to the interior. The shipments average about 60 sacks by steamer and 10 by rail per week. Each sack contains 110 pounds, the wholesale price being $2.50 per sack; retail price, $3.

Salmon canning.—The salmon-canning industry was begun on this river in 1887, when two small factories were started, and a third was built the following year. The total output of these three establishments in 1888 amounted to 5,088 cases. In addition to the salmon taken in the Yaquina River, the canneries purchased 40,764 pounds of salmon from the Indians on the Siletz River Indian Reservation, paying the same price per pound as was given to the fishermen on the Yaquina. The three canneries are located as follows: One on Idlewild Point, below Oysterville, another a short distance above that town, the third on the south side of the stream to the eastward of that place.

The tables which follow give in detail the extent of the fisheries of Yaquina River and Bay in 1888.

Persons employed.

Country.	Fishermen.		Factorymen.	
	Nativity.	Nationality.	Nativity.	Nationality.
United States	[illegible]	[illegible]	6	6
Russia	20	10		
Sweden	15	5		
Norway	8	5		
Italy	2			
China			55	55
Total	75	75	61	61

Apparatus and capital.

Designation.	No.	Value.
Boats	75	$[illegible]
Gill nets	75	7,[illegible]
Seines	2	[illegible]
Pound nets and trap nets	2	[illegible]
Shore property		10,000
Cash capital		[illegible]
Total		41,[illegible]

Products and values.

Species.	Quantity.	Value.
Salmon ......pounds	[illegible]	$15,[illegible]
Oysters ......sacks	2,[illegible]	6,250
Total		21,[illegible]

37. FISHERIES OF THE SILETZ RIVER.

This river is included within the limits of the Siletz Indian Reservation and empties into the Pacific about 25 miles north of Yaquina River. It is abundantly supplied with salmon trout and other local species; salmon also occur there in considerable numbers during the migratory or spawning season. None but Indians are allowed to pursue fishing on this stream. The United States Government furnishes them with twine, with which they make their nets. The reservation is populated by 607 Indians, including men, women, and children. During 1888 the Indians captured and sold to the canning establishments on the Yaquina River 40,764 pounds of fresh salmon, for which they received the sum of $1,222.92, or 3 cents per pound. It was estimated by Mr. B. Gaither, the agent at the reservation, that the Indians capture about 60,000 pounds of salmon annually for consumption during the winter months. The fishing carried on by the Indians is of a semi-professional nature, and no figures were obtained covering the personnel, boats, and apparatus of capture.

Products and values.

Species.	Pounds.	Value.	Remarks.
Salmon	40,764	$1,223	Sold to Yaquina River canners.
Do.	60,000	1,800	Home consumption.
Total	100,764	3,023	

38. FISHERIES OF THE NESTUGGAH RIVER.

This stream is of small importance so far as its fisheries are concerned. It is located in Tillamook County, Oregon, about 75 miles south of the Columbia River entrance. Its fisheries are confined entirely to salmon, which occur between August 15 and November 1. Quinnat and silver salmon are caught and sold for canning purposes. There is but one salmon-canning factory on this river, which began operations in 1887. The output was 4,300 cases in 1887, and 5,000 cases in 1888.

Statistics.

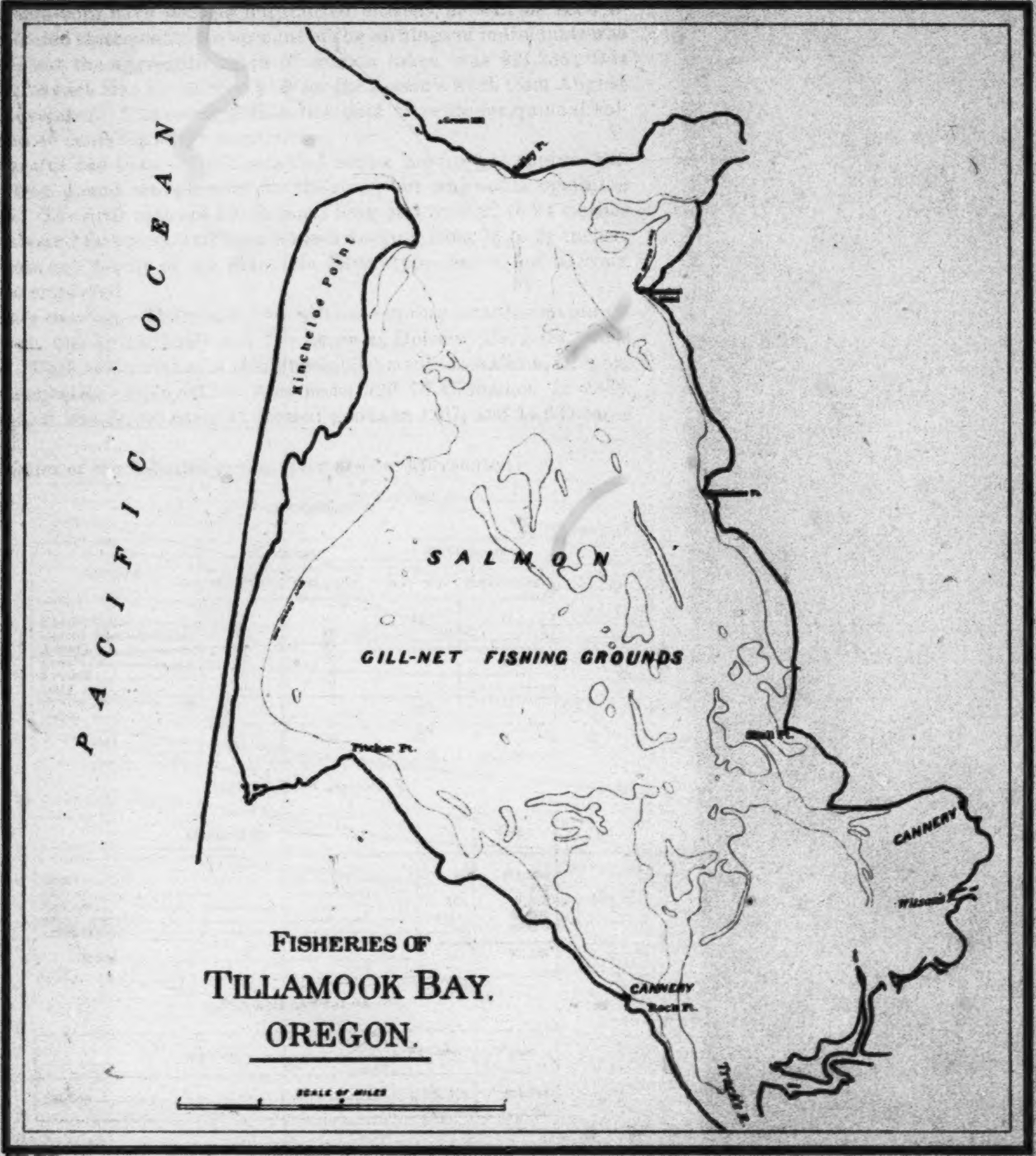
Fishermen employed:	
By nativity—	
United States	6
Austria	15
Russia	10
By nationality—	
United States	16
Austria	10
Russia	5
Factorymen employed (nativity and nationality):	
United States	3
China	35
Apparatus and capital:	
15 boats	$150
15 gill nets	1,125
Shore property	12,000
Cash capital	20,000
Products and value:	
350,000 pounds salmon	5,250

39. FISHERIES OF THE TILLAMOOK RIVER.

Tillamook River is located in Tillamook County, Oregon, and empties into the Pacific Ocean about 45 miles south of the mouth of the Columbia River. The large quantities of salmon which pass into the river during the migratory season make this otherwise insignificant stream an object of noteworthy importance.

Species, seasons, etc.—While numerous species of fish are found in the river, the fishery is limited to quinnat and silver salmon, which enter the stream in about equal numbers during the fall. The fishing begins in August, is at its height in October, and in November the number of fish taken is not large enough to warrant the continuance of fishing. From February to April, large numbers of steelhead salmon enter the river, but as the canning factories are not in operation at that time no attention is given to their capture.

Report U. S. F. C. 1888.—(To face page 196.) Pacific Coast Fisheries. PLATE XXX.


PACIFIC OCEAN
Kincheloe Point
SALMON
GILL-NET FISHING GROUNDS
Fisher Pt.
CANNERY
Wilson's
CANNERY
Rock Pt.
Trask R.
SCALE OF MILES

FISHERIES OF TILLAMOOK BAY, OREGON.

Fishermen, lay, etc.—154 fishermen were employed on this river during the fishing season of 1888. A considerable number of those who are foreign-born have become naturalized citizens, as will be seen in the tabulated statement. No account of the earnings of individuals was secured, but the aggregate value of salmon taken was $21,236; this would give each man the sum of $138 for the season's work from August until November. The canning factories paid 60 cents for quinnat salmon and 40 cents for silver salmon.

Apparatus and boats.—Drift nets and seines are used to capture salmon. One pound net is located on the river, but was not in operation in 1888. The drift nets are 100 fathoms long and from 22 to 24 meshes deep (about 2 fathoms), and have a mesh varying from 7½ to 9½ inches. The boats are mostly of the Columbia River type, but a few bateaux are also employed.

Salmon canning.—There are two salmon-canning establishments on the river, one at Garibaldi and the other at Hobsonville, a few miles above. Both are branches of similar establishments at Astoria, Oregon. These canneries employed 12 Americans and 75 Chinamen in 1888. The output was 21,000 cases of canned goods in 1887, and 14,633 cases in 1888.

Statistics of the fisheries of this river are here presented:

Persons employed.

Country.	Fishermen.		Factorymen.	
	Nativity.	Nationality.	Nativity.	Nationality.
United States	56	87	12	12
United States (Indians)	10	10		
Austria	48	35		
Russia	26	13		
Sweden	10	6		
Italy	2	2		
British provinces	2	1		
China			75	75
Total	154	154	87	87

Apparatus and capital.

Designation.	No.	Value.
Boats	70	$11,200
Seines	2	460
Gill nets	100	8,525
Shore property		22,000
Cash capital		48,000
Total		90,185

Products and values.

Species.	Pounds.	Value.
Salmon	1,074,310	$21,236

40. FISHERIES OF THE NEHALEM RIVER.

The Nehalem is a small coastal river that rises in the mountains in the southeastern part of Clatsop County, Oregon, and flows southwesterly across the northern part of Tillamook County to the Pacific. A small cannery was in operation on the river during 1887, but not in 1888; its output was 5,000 cases of canned salmon. The fish for canning purposes were caught by fishermen who came from the Tillamook to the Nehalem to engage temporarily in fishing on the latter stream, sending their products across to the canneries they were working for. There was some fishing in this stream in 1888, but the fishermen, their apparatus, and the catch have been included in the statistics for the Tillamook River.

41. FISHERIES OF NECONICUM CREEK.

Neconicum Creek is on the Pacific coast of Clatsop County, Oregon, about 10 miles south of the Columbia River. Its fisheries are of small proportions, and are tributary to the small cannery located on the creek. The entire catch is sold to the cannery, the manufactured product in 1888 being 400 cases. In 1887 the output of the cannery was 600 cases.

Statistics.

Fishermen employed (nativity and nationality):	
United States	6
Factorymen employed (nativity and nationality):	
United States	2
China	6
Apparatus and capital:	
3 boats	$225
3 gill nets	200
Shore property	800
Cash capital	1,000
Product and value:	
28,000 pounds fresh salmon	420

42. FISHERIES OF THE COLUMBIA RIVER.

Although the commercial fisheries of the Columbia River (which are almost wholly confined to the salmon industry) are prosecuted on both sides of the stream and in different States,* it is difficult and seemingly inexpedient to limit their discussion here by any consideration of State boundaries. To do this would involve a great deal of unnecessary duplication of statement. In the statistical tables that appear elsewhere the respective interests of the States are presented; but the description here, so far as it relates to the different phases of the fisheries, has essentially the same application to one side of the river as to the other. Indeed, there is an almost inseparable commingling of interests between

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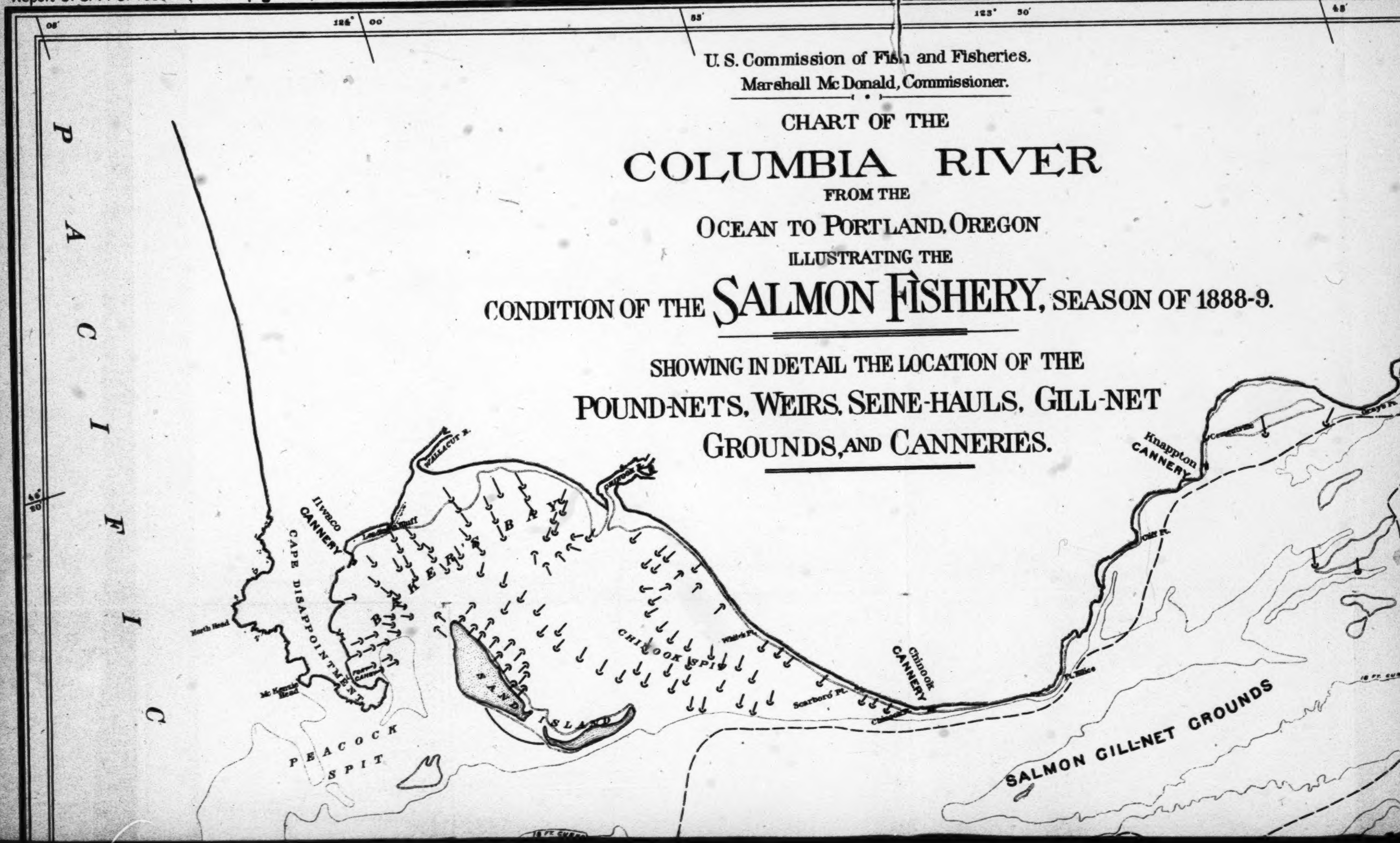
* At the time the investigation was made upon which this report is based Washington was still a Territory, but it became a State in such a short time thereafter that it is deemed best to consider it as such here.

Report U. S. F. C. 1888.—(To face page 198.) Pacific Coast Fisheries.

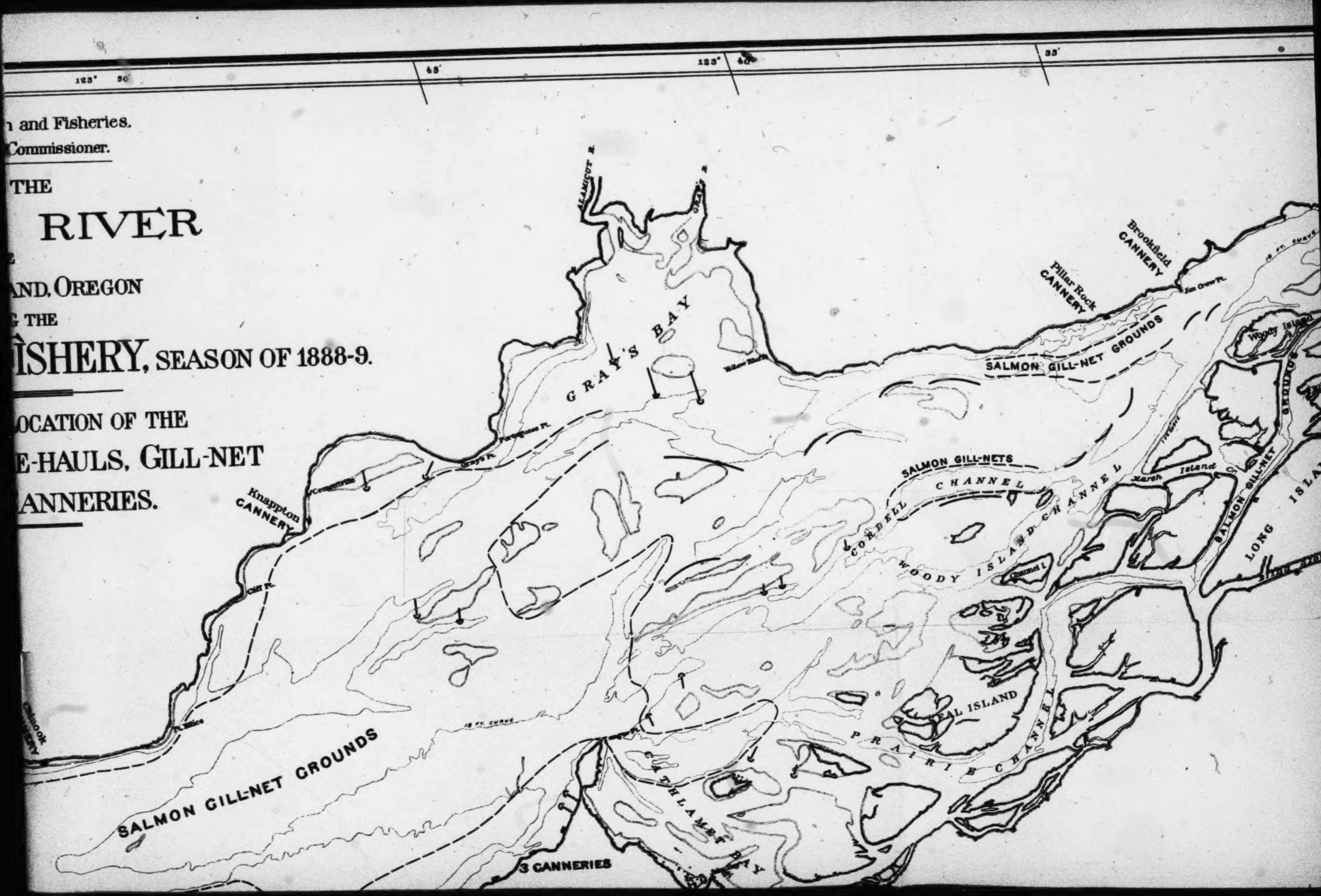


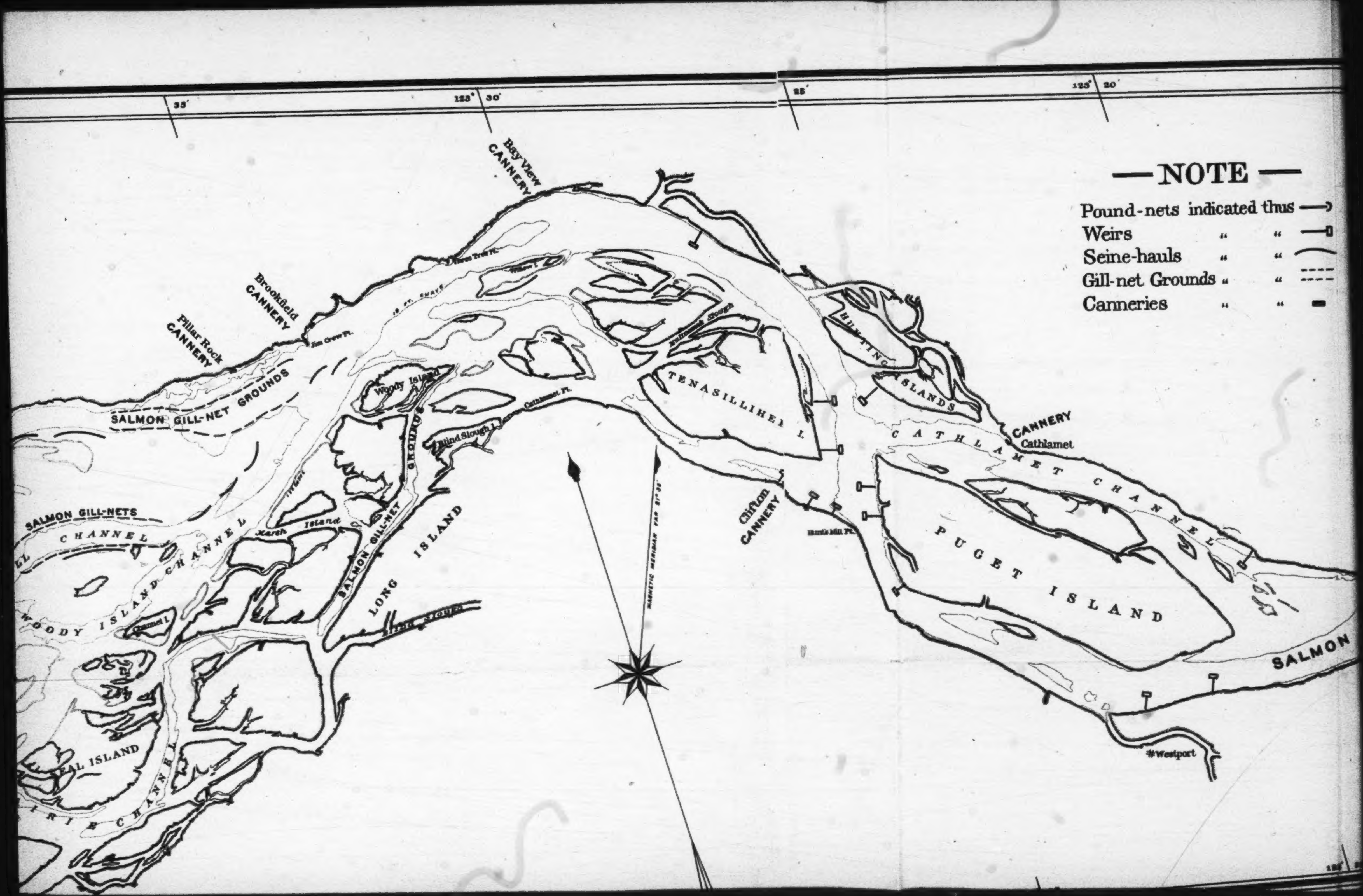
U. S. Commission of Fish and Fisheries.
Marshall McDonald, Commissioner.

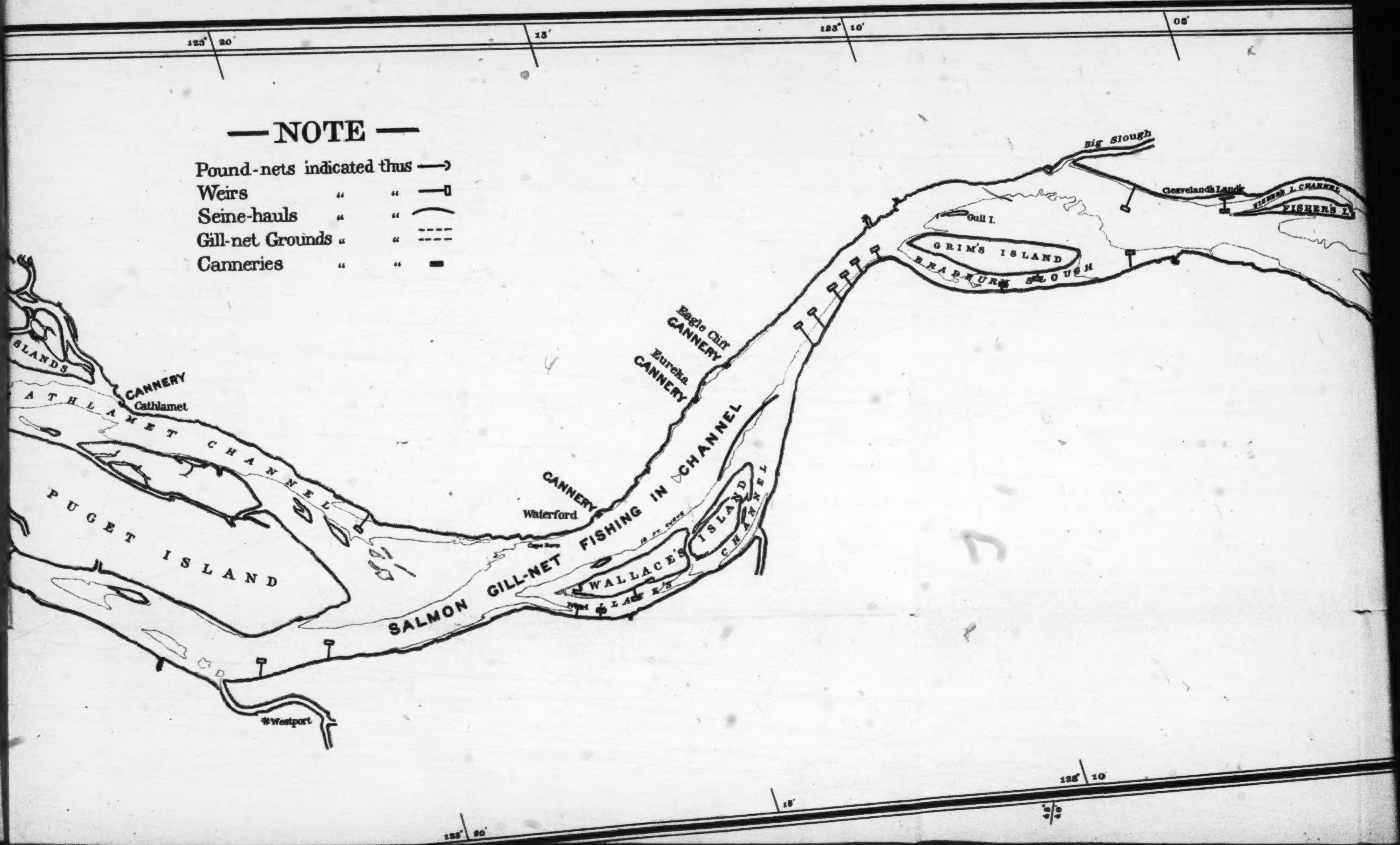
CHART OF THE COLUMBIA RIVER FROM THE OCEAN TO PORTLAND, OREGON ILLUSTRATING THE CONDITION OF THE SALMON FISHERY, SEASON OF 1888-9.

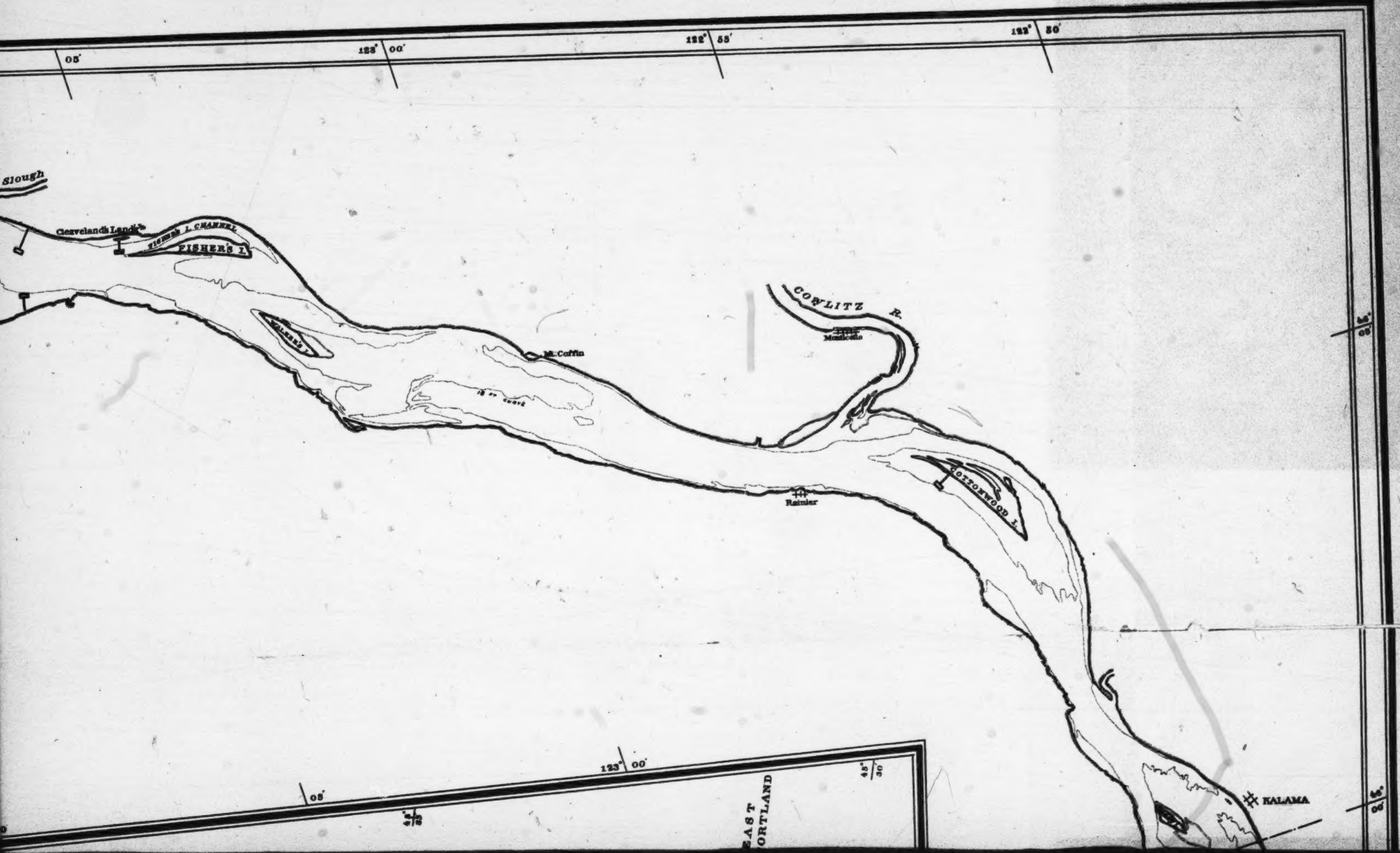
SHOWING IN DETAIL THE LOCATION OF THE POUND-NETS, WEIRS, SEINE-HAULS, GILL-NET GROUNDS, AND CANNERIES.

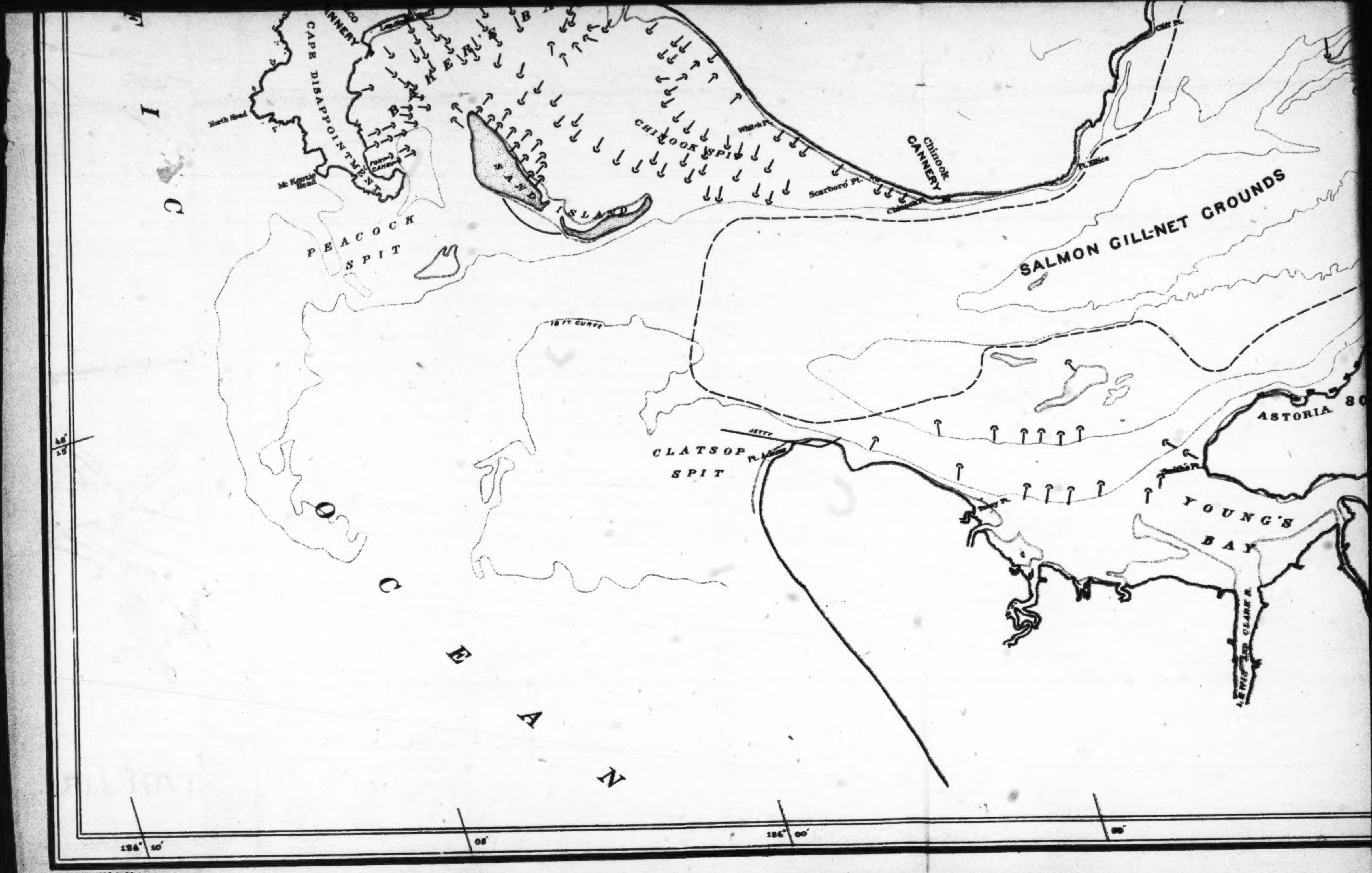
05'
124° 00'
55'
123° 50'
45'
46° 20'
PACIFIC
Ilwaco CANNERY
CAPE DISAPPOINTMENT
North Head
McKenzie Head
PEACOCK SPIT
WALLACUT R.
BAKER'S BAY
SAND ISLAND
CHINOOK R.
CHINOOK SPIT
White's Pt.
Scarboro Pt.
Chinook CANNERY
Pt. Ellice
Cliff Pt.
Knappton CANNERY
SALMON GILL-NET GROUNDS

123° 50'
45'
123° 40'
35'
n and Fisheries.
Commissioner.
THE
RIVER
E
AND, OREGON
G THE
ISHERY, SEASON OF 1888-9.
OCATION OF THE
E-HAULS, GILL-NET
ANNERIES.
GRAY'S BAY
Grays Pt.
Knappton CANNERY
Cliff Pt.
Pillar Rock CANNERY
Brookfield CANNERY
SALMON GILL-NET GROUNDS
SALMON GILL-NETS
CORDELL CHANNEL
WOODY ISLAND CHANNEL
Woody Island
Marsh Island
SALMON GILL-NET
LONG ISLAND
SEAL ISLAND
PRAIRIE CHANNEL
CATHLAMET BAY
SALMON GILL-NET GROUNDS
18 FT. CURVE
3 CANNERIES
Chinook

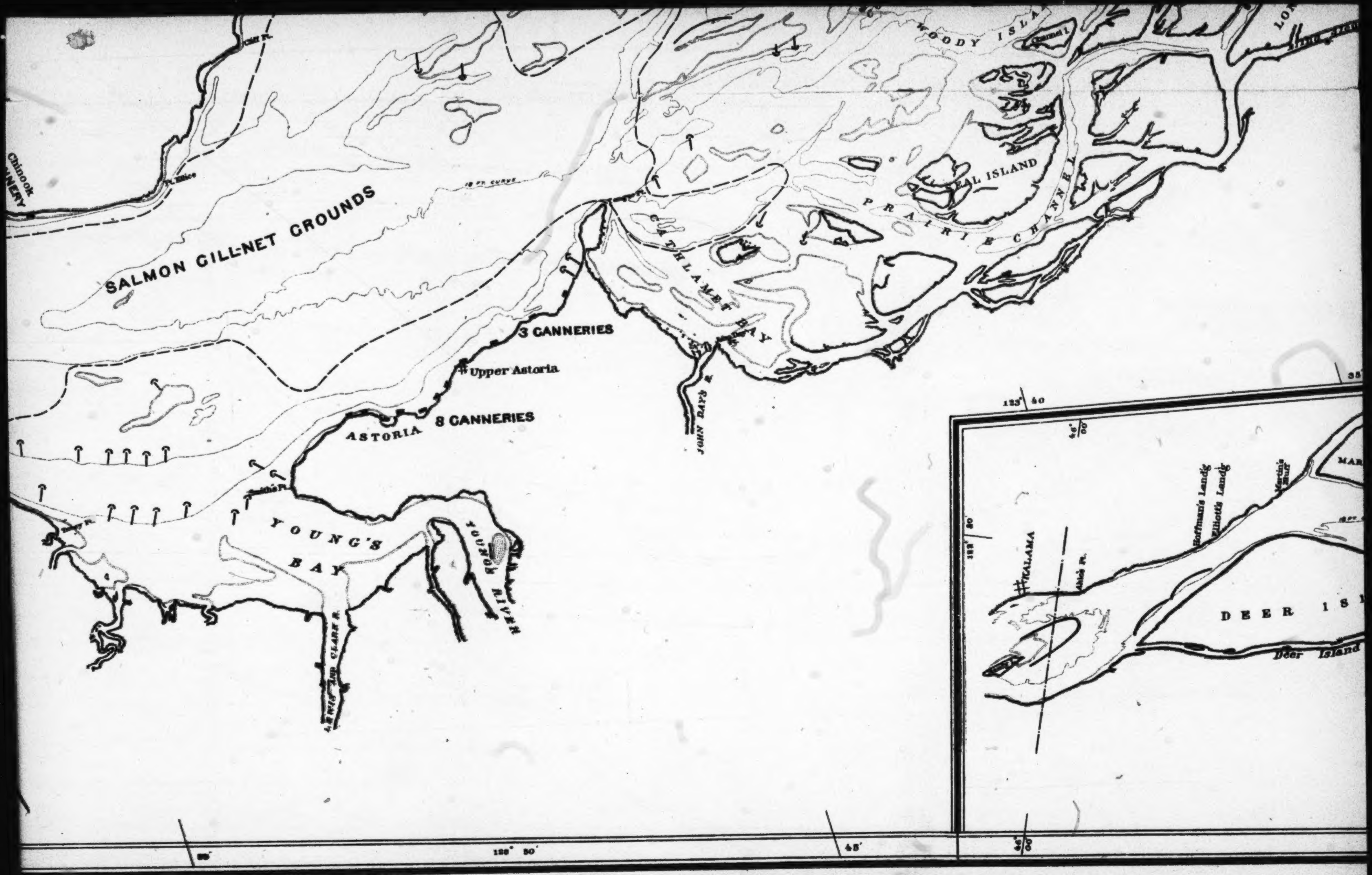

—NOTE—
Pound-nets indicated thus
Weirs " "
Seine-hauls " "
Gill-net Grounds " "
Canneries " "
35'
123° 30'
25'
123° 20'
Bay View CANNERY
Brookfield CANNERY
Pillar Rock CANNERY
Clifton CANNERY
CANNERY
Cathlamet
SALMON GILL-NET GROUNDS
SALMON GILL-NETS
SALMON GILL-NET GROUNDS
Woody Island
Marsh Island
Blind Slough
Cathlamet Pt.
LONG ISLAND
TENASILLIHEE I.
HUNTING ISLANDS
CATHLAMET CHANNEL
PUGET ISLAND
WOODY ISLAND CHANNEL
CHANNEL
SEAL ISLAND
Tenasillihee Slough
Harris Mill Pt.
Westport
SALMON
MAGNETIC MERIDIAN VAR 21° 30'


123° 20'
15'
123° 10'
05'
—NOTE—
Pound-nets indicated thus
Weirs " "
Seine-hauls " "
Gill-net Grounds " "
Canneries " "
Big Slough
Cleveland's Landg.
Fisher's I. Channel
Fisher's I.
Gull I.
Grim's Island
Bradbury Slough
Eagle Cliff
Cannery
Eureka
Cannery
Islands
Cannery
Cathlamet
Cathlamet Channel
Puget Island
Cannery
Waterford
Cape Horn
Salmon Gill-Net Fishing in Channel
Wallace's Island
Island Channel
Westport
123° 20'
15'
123° 10'

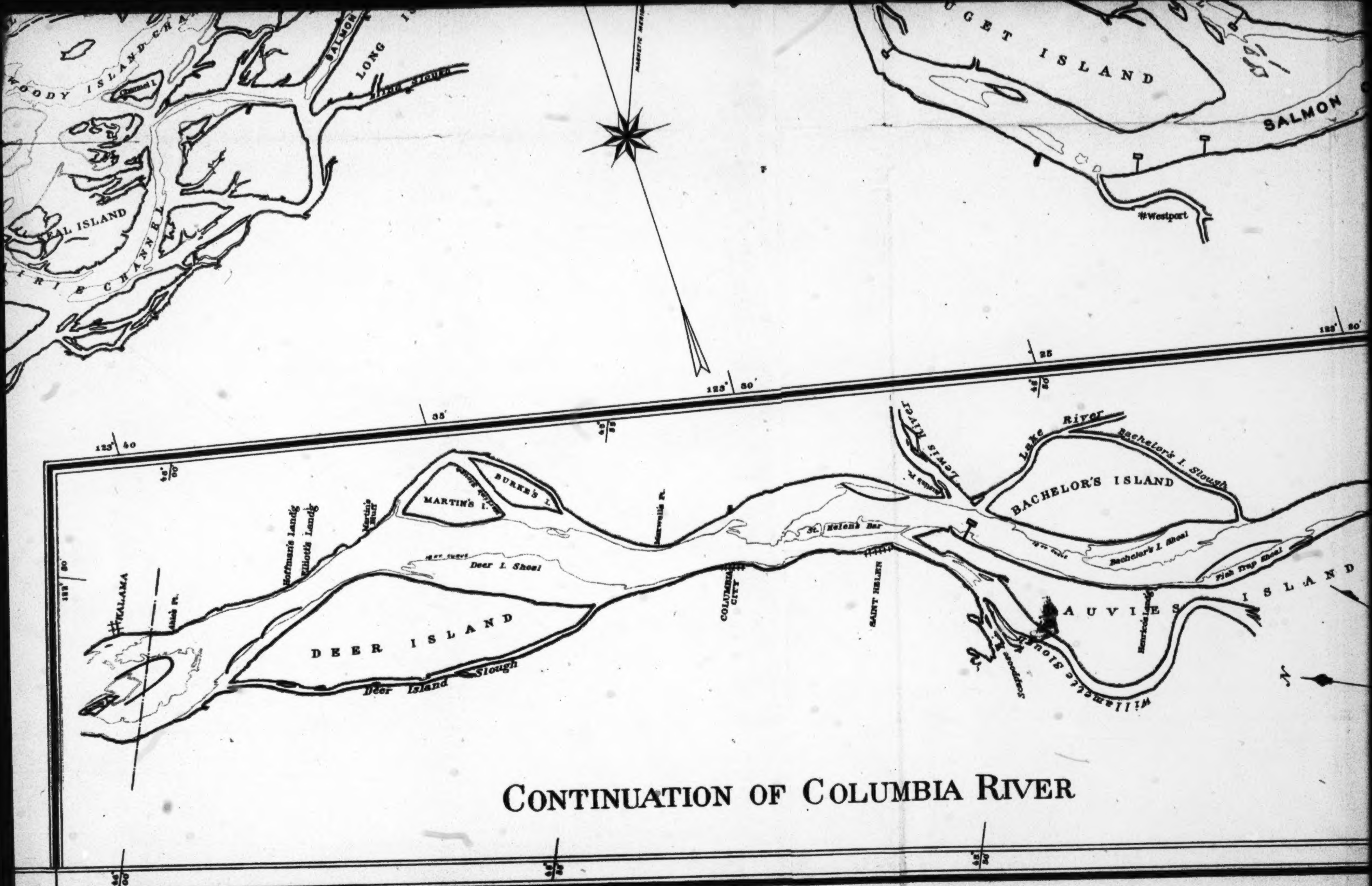

05'
123° 00'
122° 55'
122° 50'
Slough
Cleaveland's Land'g
Fisher's I. Channel
FISHER'S I.
WALKER'S I.
Mt. Coffin
COWLITZ R.
Monticello
Rainier
COTTONWOOD I.
KALAMA
46° 05'
46° 00'
123° 00'
05'
45° 30'
EAST PORTLAND



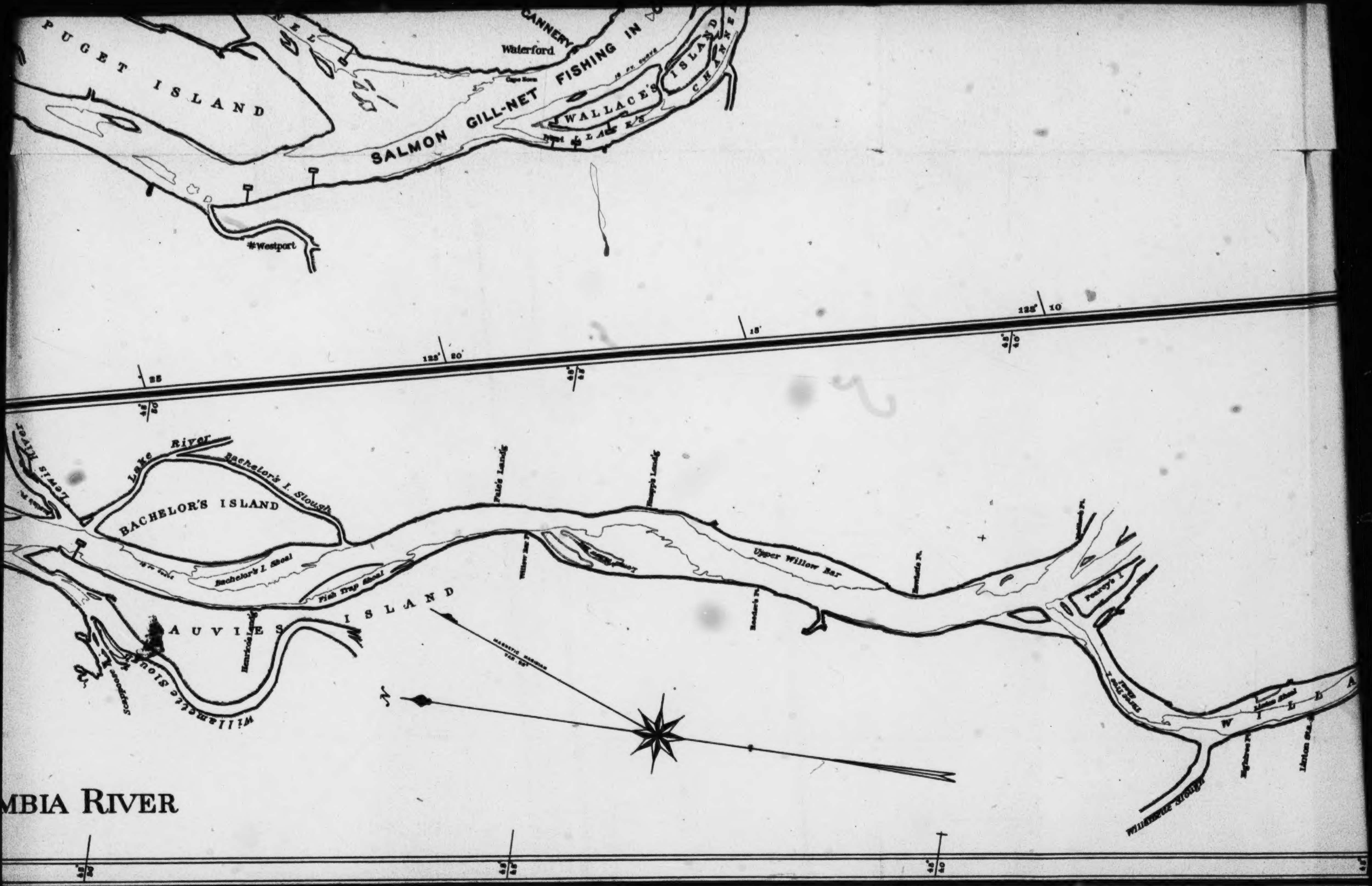
CAPE DISAPPOINTMENT
NNERY
CO
B A K E R ' S
B A Y
North Head
Mc Kenzie Head
Fort Canby
SAND ISLAND
PEACOCK SPIT
CHINOOK SPIT
White's Pt.
Scarboro' Pt.
Chinook Pt.
Chinook CANNERY
Pt. Ellice
Cliff Pt.
SALMON GILL-NET GROUNDS
18 FT. CURVE
JETTY
CLATSOP SPIT
Pt. Adams
Tansy Pt.
Smith's Pt.
ASTORIA
80
YOUNG'S BAY
LEWIS AND CLARKE R.
I
C
O C E A N
46° 15'
124° 10'
08'
124° 00'
58'
GORHAM MAR 21 88

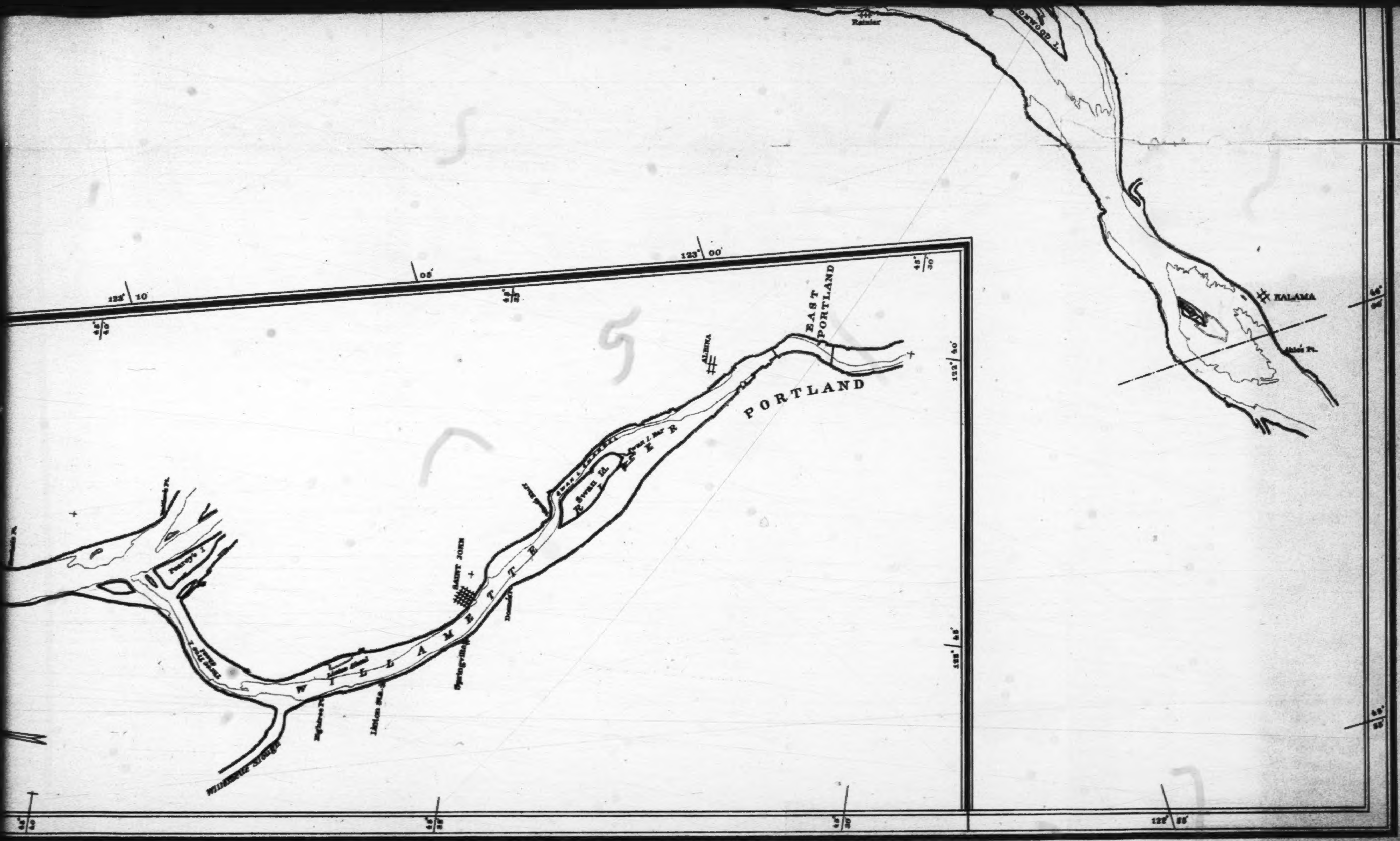


Chinook
NERY
Cliff Pt.
Pt. Ellice
SALMON GILL-NET GROUNDS
18 FT. CURVE
WOODY ISLA
LON
EAL ISLAND
PRAIRIE CHANNEL
CATHLAMET BAY
3 CANNERIES
Upper Astoria
ASTORIA
8 CANNERIES
JOHN DAY'S R.
Smith's Pt.
YOUNG'S BAY
YOUNGS RIVER
LEWIS AND CLARK R.
123° 40
46° 00
123° 50
35'
45'
KALAMA
Hoffman's Land'g
Elliott's Land'g
Martin's Bluff
MAR
DEER ISL
Deer Island


WOODY ISLAND CHA
LONG I
SALMON
SEAL ISLAND
PRAIRIE CHANNEL
UGET ISLAND
SALMON
#Westport
123° 30'
25
123° 30'
35'
123° 40
46° 00
46° 05
46° 50
MARTIN'S I.
BURKE'S I.
Martin's Bluff
Hoffman's Landg
Elliott's Landg
KALAMA
Abbe's P.
Deer I. Shoal
DEER ISLAND
Deer Island Slough
COLUMBIA CITY
SAINT HELEN
St. Helens Bar
Lewis River
Lake River
Bachelor's I. Slough
BACHELOR'S ISLAND
Bachelor's I. Shoal
Fish Trap Shoal
SAUVIES ISLAND
Henrici's Landg
Scappoose
Willamette Slough
N

CONTINUATION OF COLUMBIA RIVER


PUGET ISLAND
CANNERY
Waterford
SALMON GILL-NET FISHING IN
WALLACE'S ISLAND
Cape Horn
#Westport
123° 20'
18'
123° 10'
25
Lewis River
Lake River
Bachelor's I. Slough
BACHELOR'S ISLAND
Bachelor's I. Shoal
Fish Trap Shoal
AUVIES ISLAND
Pale's Landg
Knapp's Landg
Upper Willow Bar
Willamette Slough
Pearcy's I.
Willamette Slough
MAGNETIC MERIDIAN
MBIA RIVER


Rainier
WOOD I.
KALAMA
Pt.
122° 10'
05'
123° 00'
45° 40'
45° 35'
45° 30'
122° 40'
122° 45'
EAST PORTLAND
PORTLAND
ALBINA
WILLAMETTE RIVER
Swan Id.
Swan I. Bar
SAINT JOHN
Springville
Pearcy's I.
Willamette Slough
Linton
45° 55'
46° 00'
122° 55'
5
5
7

Oregon and Washington. In many instances canneries and apparatus operated on one side of the river are owned and controlled by capitalists residing on the other side, while fish taken in the waters of one State are caught by the fishermen of the other, who carry them to the canneries across the river, or otherwise, as the case may be. For the sake of clearness a summation of the combined fishery interests of both sides of the river is given in this chapter, together with a statement of the extent of the fisheries prosecuted from Oregon alone.

Geographical.—The Columbia River rises in British Columbia, flows through Washington, reaching the northern border of Oregon about 75 miles west of its eastern boundary; from this point the river forms the dividing line between Oregon and Washington, its general course being westerly. It empties into the Pacific at Cape Disappointment. Its principal tributaries are the Snake and Willamette Rivers, but Day's and Des Chutes Rivers are streams of some note. The Columbia is the largest river of the west coast; it is most favorably situated for the fisheries, and its headwaters constitute excellent breeding grounds for the salmonidæ.

Fishing centers.—The great fishing center on the Columbia, and the only one of marked commercial importance, is Astoria, Oregon. All other so-called fishing centers, excepting the Cascades and The Dalles, are small settlements that have grown up around the canneries. Astoria is not only the headquarters of the salmon-canning industry, but it is in all essentials a fishery center, since it is the home of a very large proportion of those persons who are engaged in fishing on the river, and is also the principal shipping point of the region.

The city is located about 15 miles from the mouth of the Columbia. It is historically interesting as being one of the first settlements on the Pacific coast, and its intimate association with the salmon industry has given it a peculiar importance in connection with the fisheries of this region. It has held the foremost position as a packing and shipping point, but in very recent years the decline in the abundance of salmon in the Columbia and the increased activity in salmon packing in Alaska have had a marked influence upon the prosperity of the town. Thus in 1887 there were 17 canneries at Astoria, while in 1888 there were but 14 canneries, and in 1889 only 11 packing establishments in active operation. In the meantime 6 firms that had formerly carried on business at Astoria removed their entire plants to Alaska. A few of the firms that still continue operations at Astoria also have canneries at points in Alaska. The city has a population of about 5,000 during the winter, which is increased to 6,000 or more during the salmon season, at which time many fishermen and cannery employés come to this section from other regions.

Astoria has many peculiarities, among which is the fact that it is built on piling and extends out over the river; the steep hills that come down to the water's edge afford little opportunity for the erection of dwellings, stores, etc., and it has therefore been necessary to construct the town in the manner mentioned. Another cause for building the city this way was that the river was shallow at this point, and it was necessary to extend the limits of the town some distance into the stream to get the requisite depth of water to enable ships to float while loading. In recent years some private residences have been built on the side of the hills back of the business portion of the town. There are few places in the world that are centers of greater activity than Astoria during the salmon season, but at other times it is comparatively quiet and uninteresting.

The Cascades is an unimportant settlement of a few hundred people, composed chiefly of persons engaged in building the locks around the Cascades. Some railroad men and a few fishermen make their homes at this point. It has some importance, from a fishery standpoint, as large consignments of fresh salmon are shipped from it.

The Dalles, a town of about 2,500 inhabitants, has a salmon cannery, which is the farthest one from the sea on the Columbia River. Like the Cascades, it is a point for the shipment of fresh salmon eastward; but beyond this it has no special importance in connection with the fisheries, though a large amount of wheel fishing is carried on in the vicinity.

Ilwaco, Washington, is a small settlement of a few hundred inhabitants, situated on Baker's Bay, in the center of the pound-net fishery. It is the southern terminus of the railroad line to Shoalwater Bay. Its inhabitants are engaged chiefly in fishing and in operating the lumber mills of the region. There is a cannery located at Ilwaco. A large percentage of the catch taken at Baker's Bay goes to other canneries on both sides of the river.

Importance of the fisheries.—The canning industry on the Columbia supports the most important river salmon fishery in the world. It has built up and still maintains many settlements, and gives employment to much capital and a large number of people. The annual product is measured only by millions of dollars, and it is doubtless safe to say that nowhere else on the globe has a like area of water produced such an immense yearly yield of wealth. There is little fishing except for salmon; sturgeon are taken to some extent, and a few fish of other varieties are caught to supply the local markets; a small amount of crayfish and clams is also secured and disposed of locally, but in this region the term "fishing" is generally applied only to the capture of salmon.

Species, seasons, etc.—Five species of salmon enter the Columbia River, but only three are sufficiently abundant or valuable to be commercially important there. One species of trout (*Salmo gairdneri*) is commonly, though erroneously, termed a salmon, its popular name being "steelhead salmon."*

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* Many of those engaged in the salmon industry on the Columbia have fallen into a great error concerning the number of species of salmon in that stream. On account of a lack of knowledge of ichthyology certain individual differences in appearance

The chinook salmon (*O. chouicha*) is by far the most important species. It averages 22 pounds in weight and attains a maximum size of 65 pounds or more. Formerly it was the only kind used for canning, and even at the present time constitutes three-fourths of the pack. The growing scarcity of the species in recent years has, however, made it necessary to utilize other varieties of salmonidæ, and now more or less is packed of other kinds. This fish runs up the following tributaries of the Columbia: Cowlitz, Lewis, and Lake Rivers, in Washington, and the Willamette, Young's, and Lewis and Clark Rivers, in Oregon. It also enters many other streams. It is well known that it runs up the Clackamas, a branch of the Willamette, where the hatchery of the U. S. Fish Commission is located.

The blueback salmon (*O. nerka*) is in favor for packing, its flesh having a bright red color. Its average weight here is about 4½ pounds. It enters the river with the chinook.

Gardner's trout (*S. gairdneri*) averages 8 to 10 pounds. It is less highly prized for canning, because the flesh is light in color and the bones hard. It is a good market fish.

White salmon (*O. kisutch*) ordinarily weigh from 8 to 60 pounds; the average is about 20 pounds. The common name of this species is due to the light color of its flesh, a characteristic which decreases its market value notwithstanding its excellent flavor. The white salmon, according to Jordan, is identical on the Columbia with the silver salmon, or "silversides," as Wilcox heard it called. The "silversides" come only in fall; they constitute the last run of the season, but receive comparatively little attention.

The dog salmon and humpbacked salmon enter the Columbia, but the latter is so rarely seen there—coming only as an estray—that the term "lost salmon" has been applied to it. The dog salmon is not considered commercially important.

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have been taken as a basis for claiming that many more species enter the Columbia than really exist. Wilcox was told that there were at least 12 species. In a report on the "Salmon Fisheries of the Columbia River" (Ex. Doc. No. 123, Fiftieth Congress, first session, page 16) W. A. Jones, major of engineers, U. S. A., has published, on the authority of Mr. G. W. Williams, a list of 12 names of salmon that "run in the Columbia River," as follows:

Chinook (*Salmo quinnat*).
Blueback (not classified).
Steelhead (*Salmo truncatus*).
White (*Salmo tsuppitch*).
Leather (not classified).
Silversides (*Salmo argyreus*).
Large white.
Dog salmon (*Salmo canis*).
Weak-toothed (*Salmo paucidens*).
Gairdneri (*Salmo gairdneri*).
Hybrid (not classified).
Humpback (*Salmo proteus*).

Professors Jordan and Gilbert, the well-known ichthyological authorities on west coast fishes, state that there are only "5 species of salmon (*Oncorhynchus*) in the waters of the North Pacific." The salmon, particularly the male fish, changes its appearance materially in the breeding season, and it is difficult for any but an ichthyological expert to determine the species correctly at such times.

Mr. Williams has apparently made 2 species of Gairdner's trout (which is not a salmon), for he calls it "Gairdneri," its specific name, and in another place classifies it as "steelhead," its common name. In the latter case a scientific name is applied which is not now recognized as properly belonging to the steelhead.

This matter is referred to in order to remove a quite common error.

Nearly all of the blueback salmon and the bulk of the chinook salmon enter the Columbia in the spring. Ordinarily the run of both begins about the last of March and continues until autumn, subject, however, to many interruptions and fluctuations from a variety of causes. As a rule the summer runs are light, but they increase when the autumn rains fill the rivers and send a volume of cold, fresh water out into the Pacific.

"Those salmon which run in the spring," remark Jordan and Gilbert, "are chiefly adults (supposed to be at least 3 years old)." A rise in the river during spring always brings in a large school of salmon, or "increases the run," as it is called. "As the season advances the smaller and younger salmon of these two species (quinnat and blueback) enter the rivers to spawn, and in the fall these young specimens are very numerous."

Mr. Livingston Stone has estimated the progress of salmon in the Columbia, after entering the river, at about 3 miles per day. At first they "play" about in the river without seemingly making any special effort to advance, though they always head toward the current. Later they gather in the deeper parts of the channel and swim up the stream.

The salmon season on the Columbia and its tributaries is limited by law. The "season" begins on April 1 and continues until August 1. There is a close season during August and September, but after this expires there is a limited fishery in the fall.

Trout and salmon trout are reported abundant in the tributaries of the Columbia near their headwaters. These may eventually become commercially important. At present they are seldom or never taken for commercial purposes, though many are caught by Indians and others living along the streams for home use, and occasionally some may find their way into the Portland fish markets.

Sturgeon of large size are abundant at least as high up as the Snake River. The maximum weight is 600 pounds,* though the fish ordinarily weigh from 40 to 200 pounds. The fishermen claim that there are three edible species of sturgeon (besides the green sturgeon, which is not eaten), but this is undoubtedly an error, for the best authorities mention only *A. transmontanus* in addition to the green variety. Flounders and soles are taken in considerable numbers near the river's mouth, but are not saved. Herring do not regularly enter the river. Smelt are abundant in February and March in the Columbia and several of its tributaries. Sardines are numerous from July to October. Suckers and "Oregon pike" are plentiful enough, but are not in demand except by Chinese. Shad weighing from 4 to 6 pounds enter the river in small numbers. A few are taken in pounds and wheels. Lamprey eels (*Ammocoetes tridentatus*) are very abundant, and are the only eels found in the river. They have a habit of crawling out on the rocks or ledges on the river banks at The Dalles, Cascades, and at Oregon City, a the Willamette, and, being indifferent to the approach of man, they are easily picked up. There is no regular fishing for them as for other species, though some are taken in the fish wheels with other kinds of fish. They are little esteemed commercially and comparatively few are saved. Those taken are sold for bait to the sturgeon trawlers, and a few are salted at Oregon City. Jordan states that this species of eel "reaches a length of 2 feet, and becomes very fat. It is never used as food so far as we know."* There are a few perch in the Columbia and tributaries. A few crayfish are taken. The razor clam is very abundant at Clatsop Beach, a few miles below Astoria, and is the object of a small fishery.

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* A sturgeon of this size is said to have recently been taken at The Dalles.

Fishing grounds.—So far as commercial fishing is concerned, the fishing grounds extend from the mouth of the river to Celilo (about 15 miles above The Dalles), a distance of about 200 miles. Salmon run up several of the tributaries of the Columbia, which have already been mentioned; but, with the exception of the Willamette and the Clackamas, none of these streams can be considered fishing grounds from a commercial standpoint. The great bulk of the fishing is in the lower part of the Columbia, within 35 to 45 miles of its mouth, and the relative importance of this stretch of fishing ground is governed by its nearness to the ocean, the section below Astoria being the most productive.

Baker's Bay, on the north side and just within the river's mouth, is the favorite ground for pound-net fishing. In 1889 there were 121 pound nets operated there. A few pound nets are set in Young's Bay, opposite Baker's Bay, just below Astoria; some are scattered along the river's banks and on the bars for about 5 miles above Astoria.

The great fishing ground for drift gill nets is from the river's mouth to about 15 miles above Astoria, but drift-net fishing is prosecuted in the channel for a considerable distance farther up the river. Set gill nets are chiefly used just below the Cascades.

The fishing ground for drag seines covers about the same part of the river as that resorted to for drift gill-net fishing, though, with the exception of one hauling reach on Sand Island, in Baker's Bay, all the seine grounds are on the bars and shallow shores above Astoria, and mostly within about 15 miles of that city. A few reaches are worked, however, as high up as Fish Trap Shoal, about 60 or 70 miles above Astoria. Not many years ago these seine reaches, which are simply sand-bars that are under water at high tide, were purchased from the State for merely nominal sums—only a few dollars. Many of them are now very valuable, some being worth upwards of $1,000 each.

The grounds upon which slat weirs are operated begin about 15 miles above Astoria and continue to the lower end of Sanvies Island, some 45 or 50 miles farther up the river. These are usually set from the banks of the river or the shores of the islands bordering the channels. In some places they are numerous, but are generally very much scattered.

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*Proc. U. S. Nat. Mus., vol. 4, p. 30.

At the Cascades, The Dalles, and Celilo are the fish-wheel and dip-ne fishing grounds.

Wilcox states that from Rainier, 46 miles below Portland, to Oneonta fishing is prosecuted chiefly to supply the market. Here drift an set gill nets of small size are employed; the boats are not so large a those of the lower river, and the fishery is not of extensive proportion

The Willamette, below Portland, is frequently resorted to by th fishermen on the Columbia, and is embraced in this report.

The number and location of pound nets, slat weirs, and wheels ar shown on the maps, plates XXXI and XXXII, on which also are define the seine-reaches, gill-net grounds, etc.

Fishermen, factory hands, lay, etc.—The fishermen on the Columbi River are natives of many countries. In addition to native-born whit Americans and Indians, no less than twelve other nationalities are represented, of which all except the Chinese are Europeans. Natives o northern Europe are most numerous, Sweden, Norway, and Russi being largely represented. There are, too, many native-born Americans—20 per cent. of the whole—while 50 Indians engaged in fishin in 1888.* It is a noticeable fact, however, that notwithstanding th great predominance of Chinese in the canneries, very few of them engage in catching fish. Those who are classed as fishermen are simpl helpers in capacities where they seldom catch the fish themselves, bu fill places where they do not come into competition with other fishermen. Most of them, if not all, are employed in connection with th fish wheels. As a rule, fishermen of other races are inimical to th Orientals, and the latter seldom find it practicable to overcome thi prejudice sufficiently to make it possible to peacefully follow fishing.

The tendency among the foreign-born fishermen to become citizens o the United States is more marked here than elsewhere on the Pacifi coast. Thus, we find that whereas only 21 per cent. of the fishermen (including Indians) are native-born Americans, no less than 71 per cent owe allegiance to the United States. Reference is made to the statistical statements relating to the fishermen for details. Wilcox found tha about one-third of the fishermen on the Columbia and its tributaries ar non-residents, who come here only to participate in the salmon fishery, and leave as soon as the season closes to engage in fishing elsewhere o to work upon farms, etc. About 900 live at Astoria, and many of them have families; others are scattered along both banks of the river, bu chiefly on the Oregon side.

On April 11, 1886, the gill-net fishermen organized as an associatio under the name of "The Columbia River Fisherman's Protective Union," and secured the incorporation of the society on August 16 of the sam year. The organization of this union was the outcome of a strik

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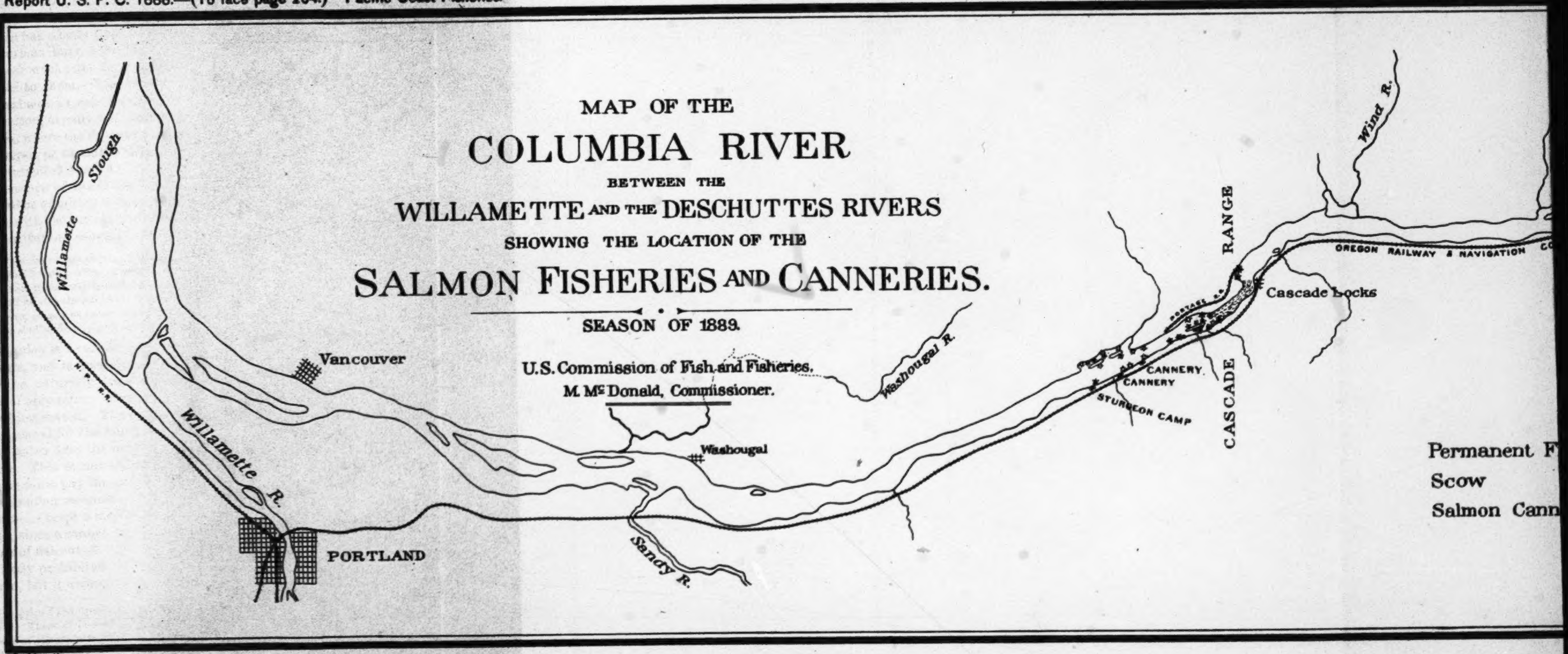
* A great many Indians fish for themselves on the upper river, but not in a commercial way. These have not been included, nor was it practicable to get any estimate of the fish taken by them.

Report U. S. F. C. 1888.—(To face page 204.) Pacific Coast Fisheries.

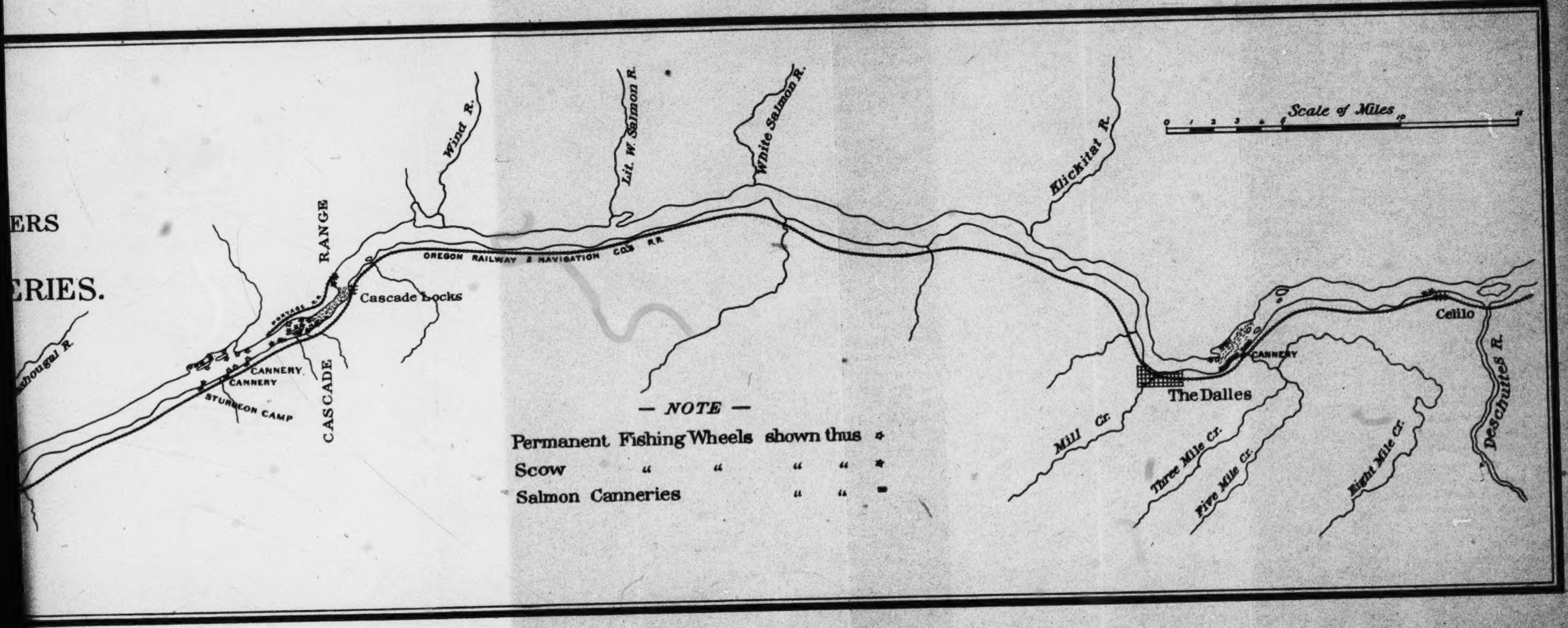


MAP OF THE
COLUMBIA RIVER
BETWEEN THE
WILLAMETTE AND THE DESCHUTTES RIVERS
SHOWING THE LOCATION OF THE
SALMON FISHERIES AND CANNERIES.
SEASON OF 1889.

U.S. Commission of Fish and Fisheries.
M. McDonald, Commissioner.

Willamette Slough
Willamette R.
N. P. R.R.
Vancouver
PORTLAND
Washougal
Washougal R.
Sandy R.
STURGEON CAMP
CANNERY
CANNERY
PORTAGE R.R.
CASCADE RANGE
Cascade Locks
Wind R.
OREGON RAILWAY & NAVIGATION CO
Permanent F
Scow
Salmon Cann

PLATE XXXII.


ERS
ERIES.
Washougal R.
CANNERY
CANNERY
STURGEON CAMP
CASCADE
RANGE
PORTAGE R.R.
Cascade Locks
Wind R.
Lit. W. Salmon R.
White Salmon R.
OREGON RAILWAY & NAVIGATION CO'S R.R.
Klickitat R.
Scale of Miles
0 1 2 3 4 5 10 15
The Dalles
CANNERY
Celilo
Deschutes R.
Mill Cr.
Three Mile Cr.
Five Mile Cr.
Eight Mile Cr.
— NOTE —
Permanent Fishing Wheels shown thus ⚙
Scow " " " " ✱
Salmon Canneries " " ▬

against the canneries, which offered the fishermen 55 cents per salmon for the season. The strike continued until the middle of May (at an estimated loss to the business of $500,000), when the canners acceded to the demands of the fishermen by paying 65 cents per fish. In 1889 the union had a membership of about 2,500, which included all the drift gill-net fishermen on the river. The headquarters are at Astoria, where the union has a large reading room on the main street of the city. Here the fishermen have collected a considerable number of books bearing upon their work; the leading periodicals and the daily papers are also available to them. This is the meeting place of the union, and here such business as comes before it is transacted. Some officer of the organization, usually the secretary, is continuously on duty at the headquarters, where the fishermen assemble in the evening to read the news, or converse, or to amuse themselves by playing games.

It is intended that the organization shall be composed only of gill-net fishermen of the Columbia River and its tributaries, and that no one shall be admitted to membership whose influence may in any manner conflict with the interests of the union. The following, extracted from the constitution, shows the limitations of membership:

> No liquor dealer, gambler, politician, capitalist, lawyer, agent of or for capitalists, nor persons holding office, whether under the national, State or municipal government, shall under any consideration become members of this organization, but all such shall be strictly excluded from membership in this union. No stockholder or shareholder of any cannery is eligible to membership in this union. Protection to members shall only apply to the Columbia River and its tributaries.

The union is decidedly opposed to methods of fishing other than with gill nets, and is specially antagonistic to pound nets and wheels. It therefore naturally does not affiliate with those who operate such forms of apparatus. The dues are $4 per annum, or $1 per month for the fishing season. There are no benefits, except that a sum of $50 is appropriated for the burial of deceased members of good standing.

The union fixes the prices of gill-net salmon at the beginning of the season. This is not changed without consulting the union, and the canners must pay the rate decided upon or stop operations, since they have no other recourse and no voice in the matter.* Indeed, no gill-net fishermen except a member of the union can sell salmon at the canneries, since a canner who bought of others would be liable to have his supply of fish cut off. The employment of a non-union man on the boats is strictly prohibited. Not only does the union determine the price of salmon, but it arranges the lay of the fishermen, both as concerns the relations between capitalists and fishermen and those between the men themselves.

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* The price fixed upon relates to salmon above a certain size, which is usually 24 pounds. Those of less weight count as two for one, or else they are weighed and the average of the standard size is taken for determining the number. Bluebacks and steelheads are usually sold by the pound, the price for the former being 5 cents per pound in 1888, and the latter selling for 3 cents. Sometimes three or four fish count as one salmon.

The crew of a gill-net boat consists of two men, one designated as the "captain," and the other (who always rows the boat when the nets are being shot) called the "boat-puller" or "helper." In most cases the boats are owned by the canneries, while the nets are the property of the fishermen,* but in some cases the latter have an interest in or may be the sole owners of both nets and boats. The arrangement is such that the "boat-puller" receives one-third of the money obtained for the fish at a fixed rate, while two-thirds of the proceeds go to the captain, net, and boat. Theoretically, the boat and apparatus take one share, and the other two shares are equally divided between the men.†

The terms upon which boats are obtained of the canneries varies with the exigencies of the business. In 1888 the fishermen paid from $40 to $50 for the rent of each gill-net boat, but the next spring these were furnished free of charge, and fishermen who had boats of their own received $40 extra from the canners.

During the fishing season the fishermen live a good deal on board their boats. After the nets are hauled and the catch disposed of, the boats are often run into some cove or bay, where they are brought to anchor. The fishermen in each boat then unship the rudder and set it up amidships to support one end of the gaff, the other end of which rests upon the bow. The sail is thrown over the gaff, like an awning, and this constitutes the roof to an improvised cabin or cuddy, under which the crew sleep. Coffee or tea is made over a lamp, and when the meal has been eaten the men crawl under the sail and sleep until the tide is favorable for fishing. It is not uncommon to see hundreds of boats anchored in this manner along the coves or bends in the river, out of the way of passing steamers. Absolute quiet reigns, and one who for the first time sees such a fleet, literally sleeping upon the river, is little prepared for the scene of busy activity presented when it wakes with the turning tide, and the broad bosom of the great river is almost instantly covered with boats putting out from all directions.

In many cases fishermen land the salmon at canneries near their homes, and then go home to sleep until the hour for fishing.

The fishermen who operate the pound nets, slat weirs, seines, and wheels, and those who engage in dip-net fishing, carry on their work to some extent upon different terms from those which govern the gill net fishermen, though the practice of fixing the price at so much per fish seems to be the system in most general favor amongst all the canneries and fishermen. In the case of the wheels, however, there are no fishermen, strictly speaking, since the apparatus is automatic and "pumps the fish out of the river." Men are employed simply to look after the wheels and attend to the catch.

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* Formerly the nets, as well as boats, were usually the property of the canneries, and these were rented to the fishermen, the canner receiving one-third of the catch for rent. But about 1888 this system was discontinued, and now the fishermen have to buy their own nets, though, as stated above, the boats are still rented, as a rule. It was believed by the capitalists that this would induce the fishermen to take better care of the nets than they otherwise would. A common saying on the Columbia is that a fisherman who is using his own net rarely "catches a steamboat in it," a phrase due to the fact that formerly, when the nets were owned by the canneries, the gear was often destroyed by passing steamboats, because the men did not exercise the necessary care to avoid such mishaps.

† The "boat-puller" is paid, according to Wilcox, on the basis of 25 to 40 cents for each salmon taken, or considerably less than the price paid by the canners.

The minimum size for "count" salmon caught in pound nets and slat weirs would appear to be 14 pounds, according to the testimony given before the Senate Committee on Relations with Canada (page 243, Report 1530, Fifty-first Congress). This is undoubtedly incorrect, and the error is perhaps due to a misprint. A "standard salmon" is a chinook, and Wilcox learned that, while there may be some variation at the different canneries, the generally recognized standard of weight was 24 pounds; of course a fish that weighs more, even as high as 60 pounds, counts only as one salmon. Both fishermen and cannery agents become so expert in judging of the size of salmon that the weighing is almost wholly "by the eye"; scales are seldom used to determine the weight, except in a few instances where the contract calls for the fish to be weighed and averaged.

Eighty-eight per cent. of the people at the canneries are Chinese. Of the remainder, 34 are natives of various European countries and 152 (including 15 women) were born in the United States. The whites are generally clerks, overseers, etc. Those who are interested in canning state that it would be difficult, if not impracticable, to supply the place of the Chinese in the canneries with white men who would be reliable and industrious and, at the same time, willing to work for only 4 months of each year.[*] The majority of the Chinese "help" return to the canneries season after season, and it has been stated that "a good Chinaman will make from $180 to $200 in a season." They labor largely on the piecework system, and this has proved satisfactory to employers and employés.

Many of the Chinese work for $1 per day of 11 hours, "and work as wanted, *i. e.*, leaving when told and coming at any hour set, only the time in which they are actually engaged being counted."[†] Some of the most capable receive $40 to $50 per month. The following condition at one cannery will, perhaps, give a good idea of the relative wages: This establishment had about 125 men; 30 were white men, of whom 10 were tinners and received $52.50 each per month; two boilers were paid from $3.50 to $4.50 per day, and the others (18) got $1 per day; 20 Chinese tinners were paid $50 per month; Chinese cleaners, $25 per month; fillers, $30 per month, and the remainder $1 per day when working.

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[*] See "Testimony taken by the Select Committee on Relations with Canada," United States Senate, Report 1530, Fifty-first Congress, first session.

[†] Jordan and Gilbert.

The white help in the canneries is generally hired by the month, the wages being graded according to efficiency and responsibility.

Close season.—It is unlawful to fish for salmon in Oregon during March, August, and September. In Washington fishing is not permitted in March and September. Both States prohibit fishing from 6 p. m. Saturday to the same hour Sunday during each week of the "season." These restrictions are applicable only to the Columbia; they do not apply to the small coast rivers. Although fishing is permitted on the Washington side of the river in August, little or nothing is done during that month. There seems to be a tacit understanding between the packers that it is best for all that the "season" should not continue beyond the limits fixed by Oregon. The law is generally observed by the fishermen. Occasionally one is arrested, but convictions are rare. The penalty for illegal fishing is not less than $500 nor more than $1,000 for the first offense; for subsequent offenses the court may add imprisonment, at its discretion, the term not to exceed one year.

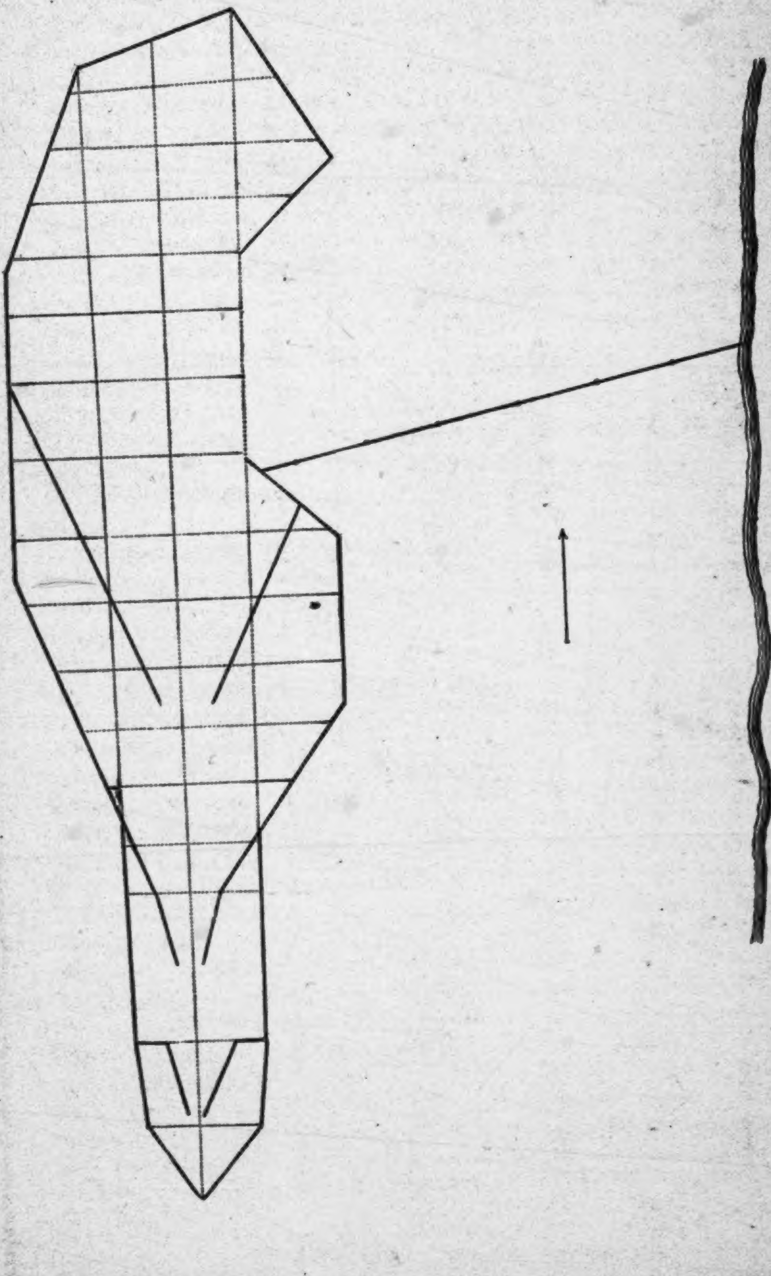
Vessels and boats.—Several small screw steamers of the tugboat pattern, a few steam-launches, and some sailing craft are employed in connection with the canneries, chiefly in transporting freshly caught fish from the fishing stations or grounds to the packing establishments. In 1888 there were employed as tenders 10 steam-tugs, with an aggregate tonnage of 192.04; 2 steam-launches, too small to be documented, but each about 4 tons measurement; a sailing schooner of 7.43 tons; a sloop of 10.43 tons; and a sloop-rigged boat of about 4 tons; these had an aggregate value of $62,450. They were manned by 50 men, nearly all Americans by birth.

In 1889 the steamer *City of Astoria* was built and added to the fleet, and the steamer *Fisher* (formerly the *Frolic*), which had been idle during the previous season, was employed as a tender. The former was 29.64 tons and the latter 32.09 tons. Thus two steamers, with an aggregate tonnage of 61.73 tons, a total value of about $15,000, and crews averaging 4 men each, were added to the fleet of tenders in 1889.

The boats employed in fishing are almost wholly of two types, viz, the gill-net boat and the seine boat.

In the Columbia River fisheries it is common to have square-ended flat-bottomed scows moored at certain favorable points near the fishing grounds. These scows are housed over and are utilized as receiving depots for the canneries. They are about 30 feet long and 12 to 15 feet wide. A cannery agent is on board each scow to receive, count, and record the catch when the fish are brought in. The salmon are thrown on board the scow, each boat or pound net is credited with its "tally" on a pass book carried by the fishermen, and at the proper time the tender comes along and the fish are soon transported to the cannery. The tugs visit both scows and boats and pick up all the fish they can get. As the salmon move up the river and the fishing ground changes

PLATE XXXIII.



SLAT WEIR FOR TAKING SALMON IN THE COLUMBIA RIVER.

the scows can be correspondingly moved to suit the convenience of the fishermen. They are used chiefly in Baker's Bay.

In the seine fishery both men and horses live on large scows when not employed in operating the nets. These scows are housed over. In some cases the horses are quartered in one end of the scow and the men in the other, but quite as frequently there are two scows to a seine gang, one for the fishermen and the other for the horses.

Apparatus.—The only really important forms of apparatus employed on the Columbia are those used in the salmon fishery. These are (1) movable gear, such as gill nets, seines, "squaw nets," and dip nets; and (2) fixed apparatus, which includes pound nets, slat weirs (or traps), and fish wheels.

Gill nets are of two kinds, called "drift nets" and "set nets," these names having special reference to the manner of using them. The gill net is the oldest and most popular form of apparatus used in the salmon fishery. In 1887 it is stated that 1,600 nets were employed in the drift fishery of the lower Columbia. The nets used in this fishery range in length from 250 to 300 fathoms or more, but are mostly about 300 fathoms. They are 45 meshes deep (25 to 30 feet), the mesh being generally 8½ to 9 inches. The minimum legal size is 8½ inches, and occasionally a 10-inch mesh is used.

The nets are all handmade by the fishermen themselves or their families; the fishermen's union prohibits the use by any of its members of factory or Chinese-made nets. Fine flax or linen twine is used; this is the celebrated "Barbour twine;" it has 12 threads and is laid slack. Hard-laid twine would not "fish well." The nets are made "between seasons" and are hung ready for use in the following spring. They are hung in the ordinary manner—to a cork rope, with floats to support the upper edge of the gear, and to a lead line with sinkers attached which keeps the net vertical in the water and all its meshes properly distended. After being hung the nets are tanned, and it is said they are tanned twice a month during the fishing season. The cost is about $300, or $1 per fathom. Nets ordinarily last about two years, but the fishermen generally expect to put in half new twine each season.

The set nets are not used in the lower part of the river, but are employed chiefly on the Willamette and near the Cascades. They are mostly machine-made; vary from 25 to 100 fathoms in length, from 35 to 50 meshes in depth, and the mesh ranges from 5 to 10 inches. Their cost is proportionately smaller than the drift nets, but will not vary materially from $1 per fathom of length.

A few reels for drying gill nets are used on the Columbia River similar to those of the Great Lakes, but generally these are not in favor. Nets are most commonly dried on shore by spreading on frames on the wharves, and occasionally they are hoisted on the masts of the fishing boats. The drying of nets precedes mending, but nets are dried after being tanned or retanned, and always after being taken from the water.

The seines are all of the type ordinarily called haul seines or drag seines, and have certain peculiarities made necessary by the fishery in which they are used. These seines are factory-made and cost from $500 to $600 each. The length of the seines varies from 200 to 300 fathoms; the shallowest end is from 35 to 40 meshes deep, but it gradually increases in width and is from 120 to 140 meshes deep at the other wing. The "bunt" or central part of the net is about 50 fathoms long, and this section has a mesh of 4½ to 5 inches; the size of the mesh in the wings is 6 inches. The outfit of a seining gang includes, in addition to the seine itself, boats, warps, horses, scows for the men and horses to live upon, etc., the whole reaching an aggregate of $1,500 to $1,800.

The large dip nets used for catching salmon at The Dalles and Cascades are similar to the nets employed for dipping mackerel, herring, and menhaden from seines, weirs, and pounds on the Atlantic coast. An iron hoop, about 2½ feet in diameter, is secured to the end of a stout pole some 18 to 20 feet long, and to the hoop is fastened a bag-shaped net 3 feet deep, with a 3-inch mesh. A net of this kind, with accessories, such as platforms, etc., costs about $20.* Rude wooden platforms are built out from the shore over the rapids, and on these are boxes to receive the fish. The fishermen stand upon these to operate the dip nets, and therefore the platforms may appropriately be considered a part of the apparatus.

The "squaw net" is used by a few of the dip-net fishermen. It derives its name from the fact that it is the same net commonly used by Indian squaws for taking salmon. It consists of an oblong sheet of gill net about 12 feet long and 8 feet deep, its lower edge weighted to keep it down, and its upper edge attached to a pole that floats at the surface, and which is held by a line or lines to another projecting pole that is securely fastened to the shore so that it will not swing around with the strain of the swift current upon the net. The mesh is the same as that of the set nets. A single block is attached to the pole, and through this passes a rope, thus making a tackle for the more convenient manipulation of the net.

Pound nets were introduced on the Columbia River in 1879. In May of that year Mr. O. P. Graham, formerly of Green Bay, Wisconsin, built a pound net on the river similar to those used on the Great Lakes. The success of this venture led to the employment of more apparatus of this kind, and many lake fishermen went West to participate in the fishery. In 1888 105 pound nets were operated, and this number was increased to 154 the next season.

The pound net of the Columbia River is the same as that used on the Great Lakes. It consists of a leader of varying length, but usually from 400 to 600 feet long, and a harpoon-shaped heart terminating in a

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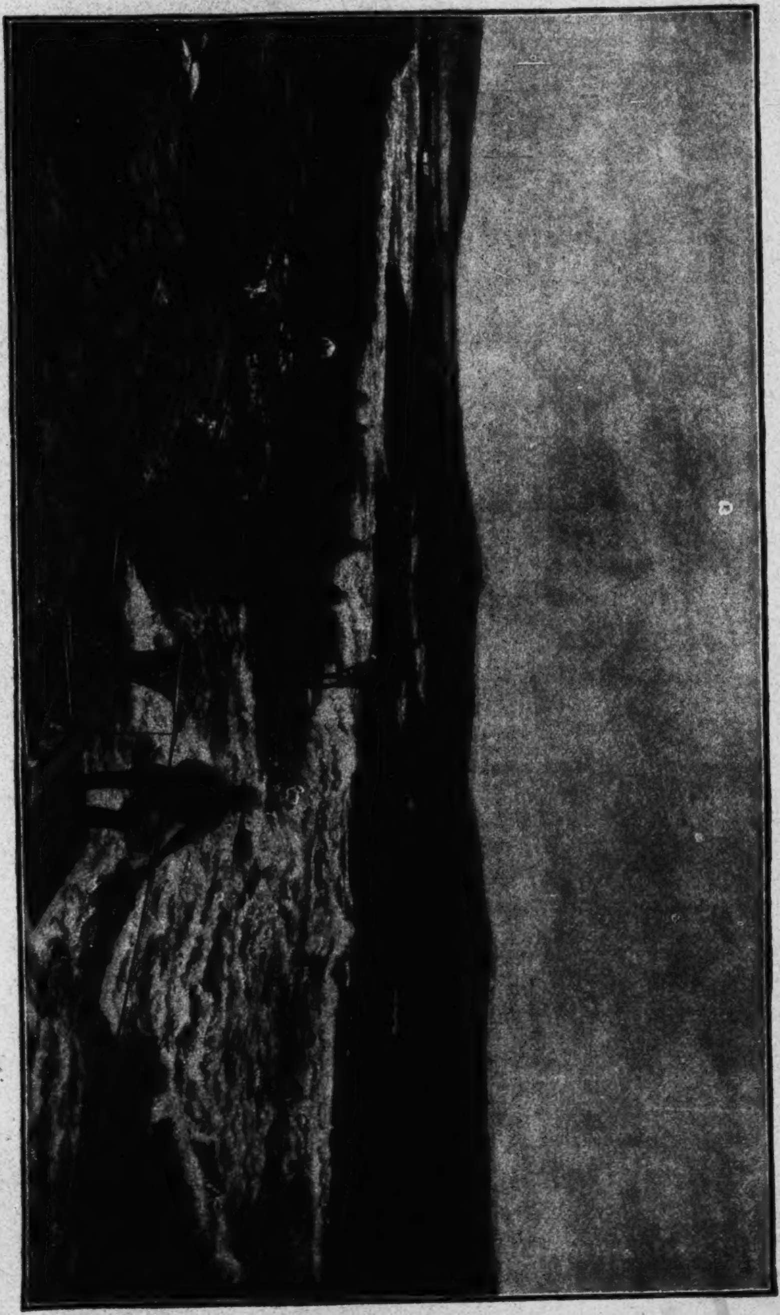
* The valuation is intended to be an average which will cover the squaw nets that are used by the dip-net fishermen, and for this reason no separate figures are given for squaw nets in the statistical tables.

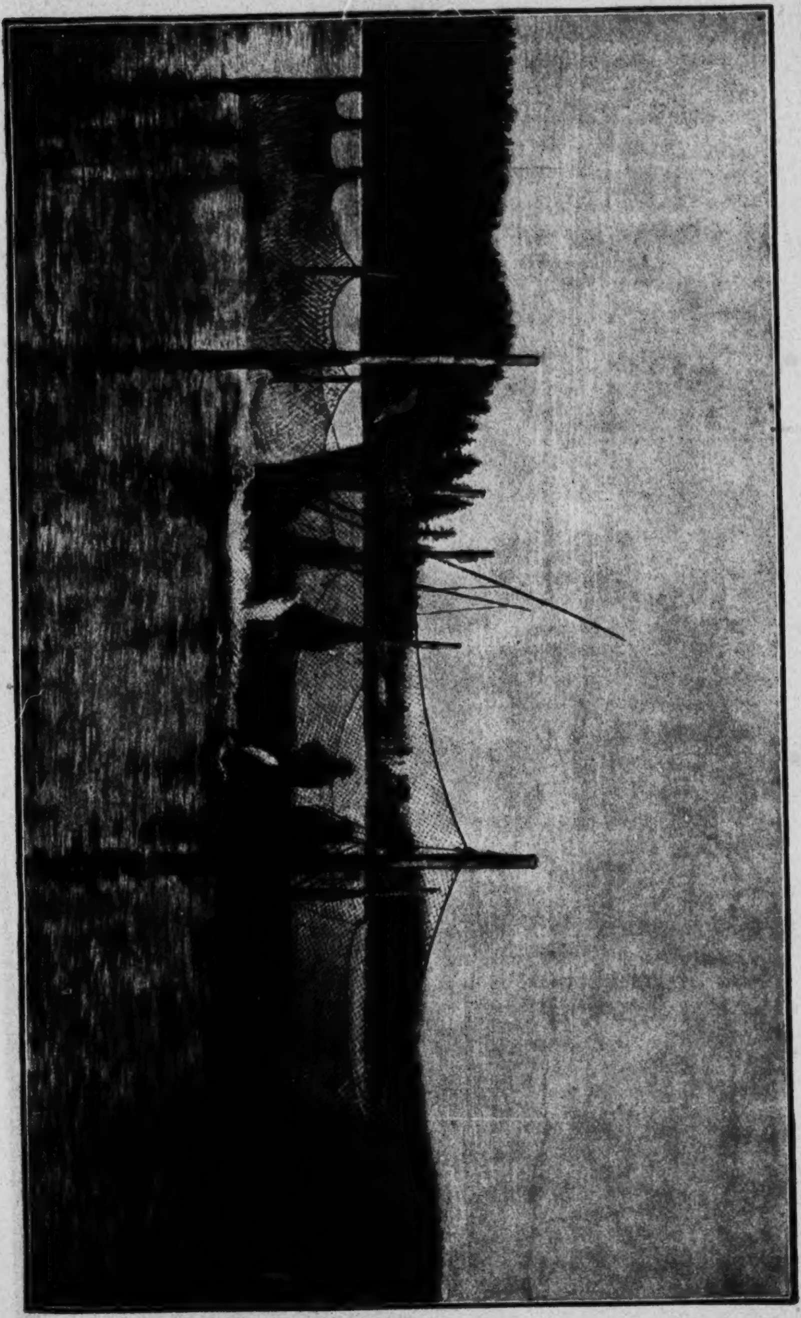
PLATE XXXIV.

SEINE FISHING.

PLATE XXXV.



DIP-NET FISHING.



POUND-NET FISHING.

funnel through which the fish enter the square crib or pound. The leader, which runs out from the shore or shoal, is made of twine or of galvanized wire netting, stretched upon poles or piles that are driven into the bottom. The use of wire for pound-net leaders is comparatively recent. In fresh water it lasts several years, and is a good substitute for twine netting, but in salt water it can not be used more than one season, consequently it is being discarded by the fishermen on the lower river. The wire netting, in sheets 5 feet wide, costs 11 cents per running foot; when 3 feet wide the price is 8 cents per foot. Only about 12 per cent. of the pound nets have wire leaders. The heart and crib are constructed of twine netting stretched on poles, and the bowl is so arrranged that it can be "lifted" for the purpose of removing the fish. During the weekly close season (Saturday evening to Sunday evening) the funnel through which fish enter the crib is lifted so that the pound can not catch anything. The size of the mesh is as follows: Leader, 6 inches; heart, 5 inches; crib or bowl, 4 inches. The cost of a pound net varies from $700 to $1,000.

The so-called wooden "traps" are essentially weirs, and are a modification of the brush weirs or traps used by the Indians for the capture of salmon long before the advent of white men.

The wooden weirs have been employed in the Columbia salmon fishery for 20 years or more, and their use dates back nearly to the beginning of the industry. They are built on shore, of piling and planks, the latter arranged like slats with spaces between. The general features of the construction, form, etc., are shown in the plan, plate XXXIII. The apparatus consists of a leader, generally from 200 to 600 feet long, two arrow-shaped hearts, with funnels that lead into the crib or box where the fish ultimately find their way. The weir is arranged to intercept the fish on their passage up the river; it therefore has an entrance on only one side of the leader—the down-river side. The instinct of salmon to go up stream is so strong that as soon as they enter the trap they immediately turn their head up the river and therefore are all the easier led into the upper section of the weir, from which there is no escape. The bowl is, however, provided with a movable trapdoor that can be opened during the close season, and on Sundays, so that the fish can pass through and run up stream. These weirs, after being built, are launched into the river, placed in proper position, and then ballasted so that they sink to the bottom. They are always located near the shore, and often they can not be fished when the water in the river gets unusually low.

Fish wheels are of two kinds, the floating or scow wheel that can be moved about from point to point, if need be, and the shore wheel, which is permanent. In either case the principle is the same. The so-called scow wheel may be thus described: The float consists of a large square-ended typical scow that is usually decked at one end and open at the other. Several stanchions, some 8 to 10 feet high, support a framework upon which an awning is spread to protect the fish from the sun's rays and the crew from rain, etc. To one end of the scow are fastened two upright posts, which are guyed by wooden supports, while projecting from the same end is the framework that supports the wheel. The wheel itself is composed of three large scoop-shaped dip nets made of galvanized-iron wire netting, with a mesh of 3½ to 4 inches. These nets are the buckets of the wheel, and they are so arranged on a horizontal axis that when the scow is moored with this end down stream the wheel is kept in constant motion by the current, and thus picks up any fish swimming up the river which come within its deadly circle. The nets are fixed at such an angle that, as they revolve, their contents fall into a box chute through which the fish slide into the scow.

A scow usually has a mast at the end opposite to that upon which the wheel is placed, and on deck are such mechanical contrivances as experience has shown to be necessary for raising and lowering the wheel. During the close time the wheels must be raised above the water, so that they will catch no fish.

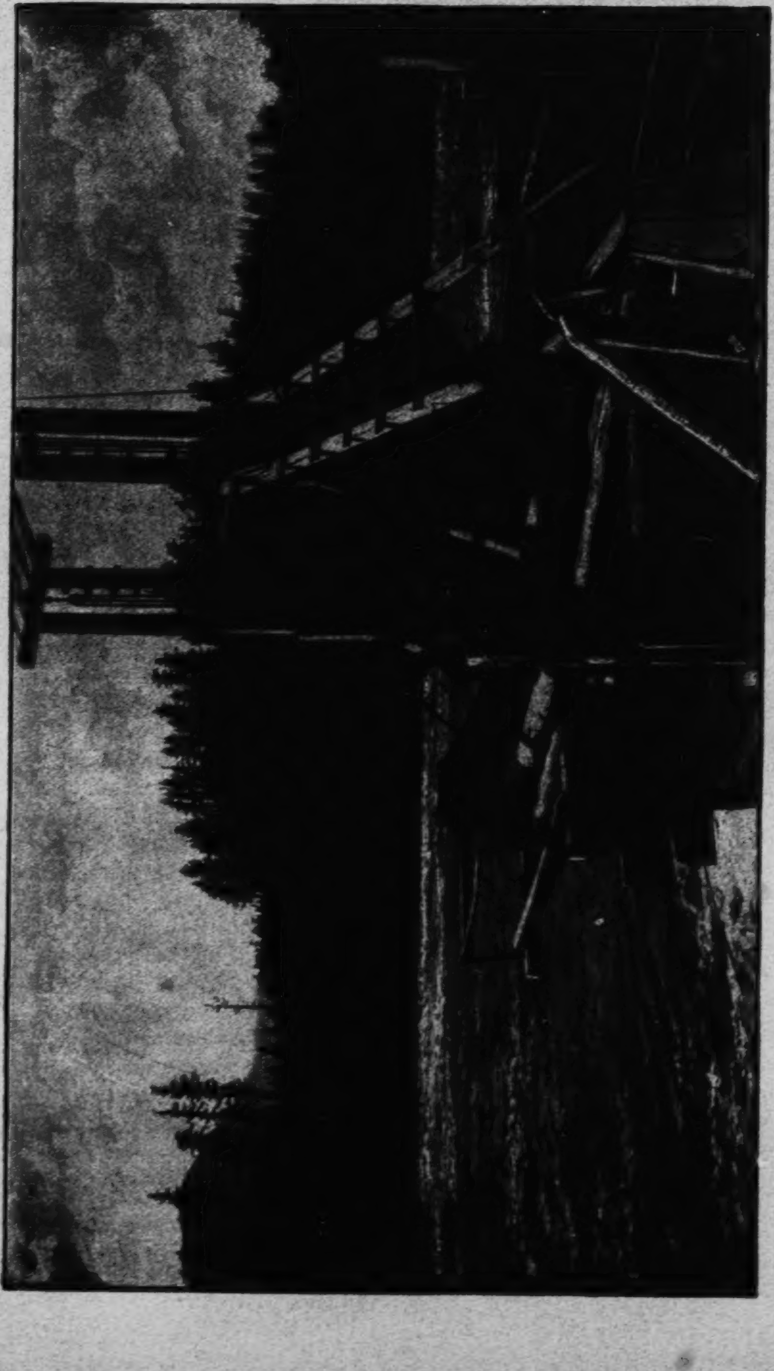
The fixed wheel is located in the most favorable position, where it is known the salmon have a sort of trail. Here an abutment is built of wood and stone, high enough to protect it from an ordinary rise in the river. To this is attached the necessary framework and the wheel, the latter being generally so placed that the full force of the current will come to it. The fish are carried through a chute into a large bin on shore, where the salmon are prepared for transmission to the canneries. The efficiency of the wheels is generally increased by building leaders in the river, so that the course of the migrating salmon will be directed more certainly to the point where their capture can be effected.

The success of the permanent wheels is frequently materially affected by low water in the river, and they are often stopped entirely from this cause. In the season of 1889 the river was unusually low, at least as late as June, and Wilcox reported that "not half of the wheels have been able to do any work." There is much variation in the size of fish wheels and a corresponding difference in their cost. The wheels range from 9 to 31 feet in diameter and from 4½ to 14 feet in width; they cost from $1,500 to $8,000. They do not often exceed $4,000 or $5,000; the most costly ones have long leaders of piling that materially add to the expense of construction.

Major Jones makes the following interesting allusion to the fish wheel and its effectiveness:

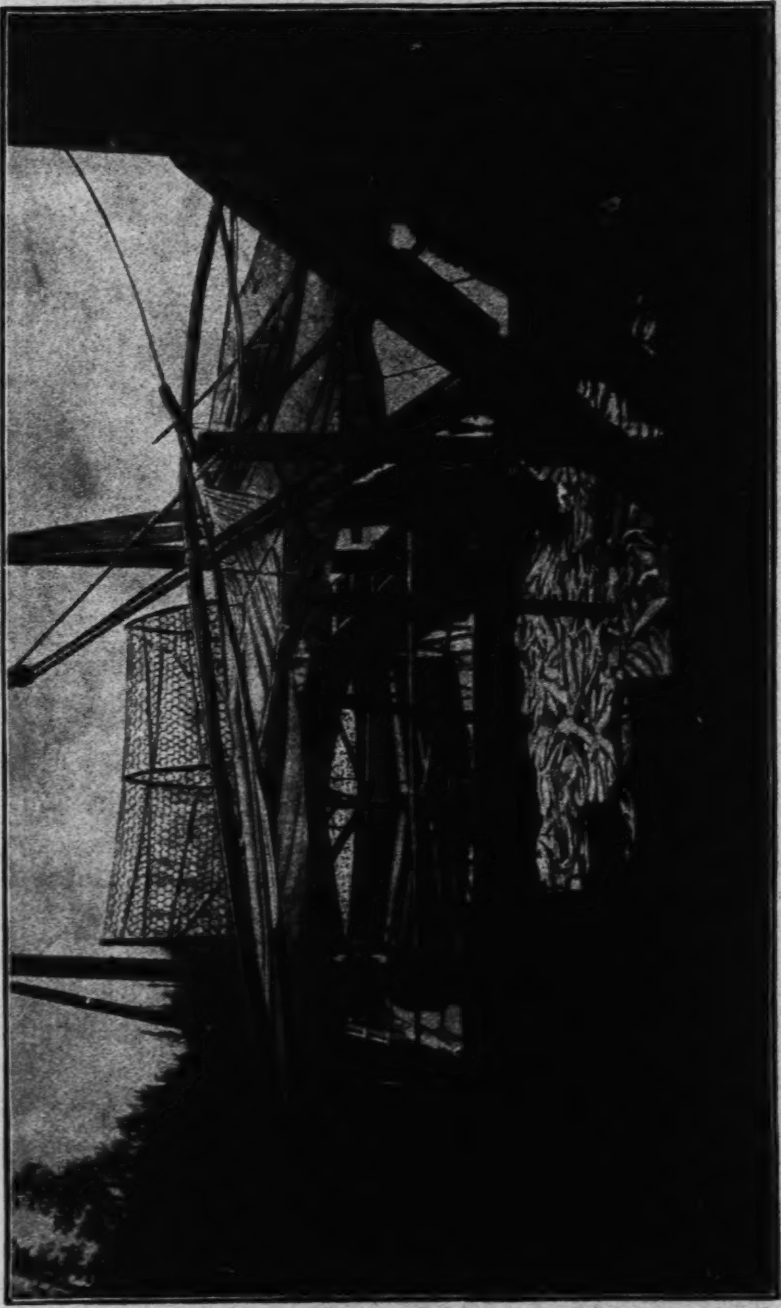
> The wheel is the apotheosis of the dip net. Imagine a white man of inventive mind standing on one of those bold rocks wearily pushing a dip net through the foaming torrent at his feet. His first thought would be a desire to have a net that would be in the water all the time, so that no fish should be able to get by. If he could handle a succession of four or five nets the thing would be accomplished. To place them on the periphery of a wheel with a horizontal axis, the wheel to carry paddles to make the current of water revolve it, would almost be a logical sequence of the thought. Elaborate the idea with some details of making the nets as wide at the mouth as

PLATE XXXVII.



STATIONARY FISH WHEEL IN OPERATION.

PLATE XXXVIII.



SCOW FISH WHEEL IN OPERATION.

> possible, and extending the bottoms inward to connect with inclined troughs placed along the axis of the wheel, so that when it revolved, gradually increasing the angle of the bottom of the net with the horizontal, the fish would gravitate towards the trough and slide out into a box placed below the shore end of the axis of the wheel, and we have a device for catching fish with a dip net that would appear simply divine in the eyes of the untutored savages who wielded it so long under the conditions of this locality.
>
> The success of this fishing machine depends on the fact that there are many points along the rapids of the river where the trails of the traveling salmon come together alongside of rocky points projecting from the shore. A wheel placed so as to cover such a trail will be tolerably certain to catch the majority of the passing fish. There are only a few points where these conditions are maintained constantly during the varying stages of the river, and where wheels may permanently be placed, and hence some wheels are placed on the ends of scows, which can be moved from point to point to meet the varying conditions of river stage. The success of the fish wheels is painful. It has been aptly remarked that they pump the fish out of a river. And yet, if it be true that nearly all of the fish die after spawning, I can see no objection whatever to their use, provided they be required to stop fishing for two days, say Saturday and Sunday of each week, and that at the same time at least one hatchery be established on the upper waters of the river.
>
> It has been demonstrated that a hatchery can insure the placing of enormous numbers of young fish in the sea annually, and the evidence of Mr. G. W. Williams shows conclusively that the place for propagating the chinook salmon is at their spawning grounds on Snake River. The wheel at the Cascades of the Columbia River, owned by Mr. Williams, catches more fish than any other. The maximum catch reported was 50,000 pounds in one day. At the time I visited the locality it was catching at the rate of 20,000 pounds per day. These wheels can only operate at certain stages of the river. At the Cascades they can not operate when the water is less than 15 feet above low water, nor when it is more than 47½ feet above.
>
> While at the Cascades and The Dalles it was stated to me that 90 per cent. of the fish caught at these points were bluebacks and steelheads, and the catch during my visit verified the statement. This shows that about nine-tenths of the large chinook salmon are taken by the nets in and about the mouth of the Columbia River. Unless something be done to allow a larger percentage than this to pass up the river it will hardly be possible to get enough of this variety on the upper waters for propagation.

The fish wheel is a patented device. It was first used by the patentees, Messrs. G. W. Williams & Brother, in 1879, and for three years those gentlemen had a monopoly of the fishery with this form of apparatus. About 1882–83 other parties built fish wheels, and fishing in this manner has rapidly increased since that time. In 1889 there were 27 stationary wheels and 18 scow wheels on the Columbia, from the vicinity of the Cascades to Celilo. Reference is made to the map (plate XXXIII) for the location of these.

Trawl lines are used to a limited extent for the capture of sturgeon. Some of these are of the Chinese pattern, fitted with barbless hooks placed 15 inches apart, with 100 hooks to each trawl. Others are rigged with ordinary American-made barbed hooks, upon which bait is used.

Methods of fishing, catch, etc.—Gill-net drift fishing is prosecuted chiefly in the estuary of the Columbia in and near the channel. If the water is clear, the nets are set only at night; but a rise in the river, which is favorable for the salmon to "run," makes the water muddy, and at such times fishing is carried on both day and night. Night fishing is most common and is preferred for several reasons. It supplies the canneries with fish early in the day, and it is thought that salmon landed then are in better order than those taken by day, when the temperature is usually higher.

In gill-net fishing on rivers it is necessary to work in a straight reach of water of fairly uniform depth and free from snags or sharp ledges. It has been aptly said that "a man can't turn a corner with a gill net." So a clear reach is selected, and this is called a "drift." In a river like the Columbia there are likely to be many drifts, and to each a special name is applied, such as "Brown's Reach," "Jones's Drift," etc. In setting the net the boat-puller rows slowly across the stream while the captain pays out the apparatus, to the first end of which a buoy and lantern have been attached. When about two thirds of the gear is out the boat is turned downstream nearly at right angles to her former course, so that the net, when set, approximates the shape of the letter L.

The foregoing is given on the authority of the Alta California, in its issue of April 20, 1884, which also had the following additional allusion to gill-net fishing:

> The position of the net in the water is peculiar. The lead line is dragging on the bottom of the river, the cork line, impelled forward by the current, keeps every mesh taut and open. At first the boat corner was at right angles to the body of the net, but the lamp end being in the deep channel, where the current is stronger, moves downstream more rapidly than the boat end, and gradually the angle closes up and the lamp end is up and downstream in a diagonal line, which crosses, perhaps, two-thirds of the main channel. The man in the boat pulls leisurely along, just fast enough to keep the corner on the net all the time and prevent the net from standing straight up and down stream. As the net is now it presents a sloping wall almost, if not quite, imperceptible to the sight of the fish, and totally impassable unless Mister Salmon would do what many a good man has to do, back down and surround the obstacle he meets. But when the Almighty made the salmon he endowed it with a degree of obstinacy unparalleled in the animal kingdom. The persistent courage of the bulldog and the wild charge of the buffalo when stampeded is nothing compared to the ascending rush of the salmon upstream when he makes his annual trip from the ocean to his favorite spawning ground. * * * When the foolish fish meets a gill net he may, perchance, be lucky enough to strike it sideways, and then he will go poking around for a time till he thinks he has the lay of the net, and finding that it runs in a diagonal line, he gives a flirt with his tail, crowds on all sail, and makes a vicious slantwise dive to make up for lost time. The instant he does this he is a doomed salmon. * * * His calculations were all right so far as the main body of the net was concerned, but the fool never stopped to calculate on the corner at the boat end, and as he dashes head foremost into the net, the fatal mesh slips over his head till it is past the gills, and each succeeding struggle only jams him tighter and tighter.
>
> When a fish is first "struck," as the fishermen call it, * * * he will start upstream, towing all the slack of the net, and * * * it is no uncommon thing for a ten or twelve pound fish, when caught near the bottom of the net, to pick up the lead line and struggle to the surface. * * * The small fish fight harder than the larger ones. A large 30-pounder will often roll into the net and stay there without making a move, but as a rule, when a fish strikes, the bobbing of the corks and the splashing of the water tells the men in the boat that they have another captive. When the boat nears the end of the drift the corner end is let loose, and away they go as hard as they can pull to pick up the lamp end of the net. The first thing to be done is to draw up the

> lead line and hold it up to the cork line. Then the boatman [boat-puller] slowly backs up to the net, and as he does so the slack is hauled in. It would not do to pull the net in, for that would draw the meshes open and all the fish would drop out. As the net is hauled in the fish are picked out of the meshes. If not already dead they are killed by a blow over the nose [with a club], for to leave a fish to slowly die in the bottom of a boat spoils its flavor.

As Wilcox observed it, the nets are "laid out" at nearly right angles, or diagonally to the river's course, so that they will intercept the salmon that are running in. Drift-net fishermen set their apparatus only on high water slack, or what they denominate "on the turn of the tide." The gill nets are put out about an hour before high water and generally drift until an hour after. As a rule salmon fishing with drift gill nets can not be profitably prosecuted at other times. The nets are allowed to float with the current for a time specified, when they are hauled into the boat and the salmon are removed. As the fish are gilled they generally die in the net. The mesh determines the size of the salmon, and no small ones are taken in the gill nets, the catch of which is almost entirely large fish of the chinook species. When the fishing is finished and the nets have been hauled into the boats sail is set, and each starts for a scow or cannery to land its catch.

As soon as the fish are disposed of the boats (unless they are at a cannery) run into some shelter and anchor until the conditions are again suitable for fishing. On Saturday, however, all of the men go home and stay there until Sunday afternoon, since fishing is prohibited by law from 6 p. m. Saturday to the same hour on Sunday. It is a beautiful sight to see a thousand or more boats starting for home on a Saturday, their white sails dotting the river for miles.

The nets set farthest down the river are often (if not generally) most successful. This leads to much competition in getting the best berths, and causes the fishermen to take great risks in venturing near the bars upon which the ocean waves always break heavily. The ebb tide runs so strongly at the mouth of the river that the boats can not make way against it; and if the fishermen wait too long before hauling their nets they are sometimes carried upon the bars, where their boats are immediately swamped. Many lives have been lost this way, and a season never passes without its dismal record of disasters.

The catch of the gill-net fishermen varies considerably with different seasons, and, as will readily be understood, there is generally a material difference in the results obtained by individual boats. It may be stated, on the authority of the Fishermen's Union, that the average catch per boat in 1888 was about 500 fish, for each of which the canneries paid $1.25. In the early history of the fishery it was not uncommon for a boat to catch four or five times that number.

Set nets are moored in the river so as to intercept the migrating salmon. The same rule applies to these as to the drift nets, so far as clear and muddy water is concerned. If conditions are favorable, fishing goes on night and day, the nets being lifted from time to time, as occasion requires, and the fish taken out.

Seine fishing is carried on upon the bars that are covered at high water, and can not be prosecuted at full flood. It is necessary at such times for the men and horses to go on board the scows and wait until the tide has ebbed sufficiently to enable them to work. The time of beginning varies somewhat at the different reaches, depending upon the depth of water at the stations at high tide. As soon as the beach or bar uncovers, so that the men can successfully wade about with their long-legged rubber boots, operations begin. The most successful time for fishing is when the flood tide begins to run in. It is then practicable to set against the tide, so that the salmon running in with the current will be stopped by the shore end of the seine first thrown over, while the crew of 5 or 6 men in the seine boat are running out and getting on shore the other end of the net.

A dory works in conjunction with the seine boat. In the dory is placed a short section of seine, or the end which is first to be thrown into the water. The location having been determined upon for setting the net, the seine-boat and dory take their positions near each other, the former headed offshore and the smaller boat headed toward the bar or beach where the haul is to be made. At the proper time the two crews begin to throw out the seine. The larger boat pulls offshore at first, circling around against the current, so that the net will nearly form a semicircle, with its convex side reaching out into the river, the first end on the bar, and the last end thrown out being some distance offshore. The men in the dory start directly for shore, as has been stated, and as soon as the short length of net which they have is thrown over they run out as rapidly as possible and haul in on the shore line, which is attached to the end of the seine, one man attending to the landing of the boat.

The object is to get the shore end of the net near the bar as quickly as practicable, and in this endeavor it is not uncommon for the men to jump overboard, even when the water is up to their waists, and begin to haul in on the line, dragging the seine shoreward. When this end of the net is near the shore the sweep of its curve forms a barrier to the progress of fish going up the river, and holds them until the shore-line from the other end of the apparatus is landed. As soon as this is done one or more horses are hitched to the line and begin to pull in the net, and as it comes in there is an effort made to work it against the current as much as practicable. While one horse is pulling in another is going out. In this way the horses are being hitched on one after the other, so that there may be a continuous pull on the seine.

These drag seines are heavy, and being set against the current, as they are, are difficult to manage. It is necessary, however, that all expedition should be used in order to prevent the escape of salmon either by jumping over the cork line or finding some outlet beneath the foot rope. When the net is finally landed the fish are taken out and loaded on a boat or steamer for transportation to the cannery. Ordinarily about three hauls of a seine can be made on a tide, but sometimes four or five.

From the mouth of the river to the Cascades there is more or less similarity in the methods of fishing; but at the Cascades and The Dalles, some 50 miles farther up the river, the velocity of the water is so great at many points that the salmon seek places where they can most readily pass.

In his report on the salmon fisheries of the Columbia River Maj. W. A. Jones remarks:

> The friction of the rocky bed and shore makes these points immediately alongshore, where one can stand and reach the fish with dip nets attached to long poles as they struggle by. These have been the favorite fishing spots of the Indians from time immemorial. Here the tribes came in summer, pitched their camps, and caught their winter's supply of food. * * * The Indian has been driven from the field, and white men have obtained from the Government the exclusive right to fish. Indians are still employed, and the illustrations show both Indians and white men at work.

When dip-net fishing for salmon the fisherman stands on a rude platform jutting out over the river, and with a long downward stroke or thrust, sweeps the net along with the current as far as he can reach, with the end of the pole on his shoulder, his body being bent strongly forward in the act. If a salmon is caught, its struggles quickly notify the fisherman of the fact, and he immediately pulls up the net and lands the fish in a box built on the platform, or in a bag which is held open by one hand while the contents of the net are dumped with the other hand. Generally, "water hauls" are most numerous, and the fisherman keeps on dipping until too weary to continue it longer. Often, however, when salmon are running plentifully, many hundred pounds are taken in a day by a single individual, though it is not infrequent for a man to work an entire day without getting a single fish. The fish are carried to the packing-house by the squaws, who use large gunny bags suspended on the back by a strap around the forehead.

The success of the dip-net fishery is very much greater than would naturally be supposed. Major Jones says:

> In one day during the season of 1887 at The Dalles fishery 4 nets took 22,000 pounds. In one season 4 nets took 800,000 pounds. At the date of my visit, July 9, 1887, 4 nets had taken 560,000 pounds up to date. During the first 7 days of July of this season [1886] these 4 nets took 114,000 pounds. These figures were given me by Mr. Seufert, the proprietor of the fishery at The Dalles.

The dip-net fisherman occasionally operates squaw nets in connection with other fishing. He sets his squaw net in a position where he can watch it while engaged in dipping, and practically within reach. When a salmon is gilled, he detects it instantly, and, dropping his dip net on the platform, he immediately pulls in on the tackle attached to the pole, and brings the squaw net to the shore. The fish is then removed and the apparatus again put in position. It has been impracticable to determine the exact quantities of salmon taken by this form of apparatus, since the entire catch of the dip-net fishermen has naturally been aggregated and credited to dip nets. It is, however, believed to be unimportant since only a few squaw nets are used.

The pound nets are lifted once a day, at or near low water. Only two men are required to lift one of these pound nets. The method of operating the pound is the same as that in vogue on the Great Lakes and the Atlantic Coast. It has been so frequently described that it is not deemed necessary to repeat the description here.

As a rule, the fish caught in Baker's Bay are taken to the scows that are moored conveniently near. In some cases, however, they are put on board of the tugs when the latter chance to be present about the time that the pound nets are lifted.

It is said that pound nets take a large percentage of steelheads and bluebacks, but that the chinook salmon caught in them seldom weigh less than 14 pounds apiece.*

In the lower part of the river, in what is called the estuary of the Columbia, pound nets have been found most effective apparatus in the capture of salmon, particularly at Baker's Bay. Sometimes very large catches are obtained. A considerable number of soles, flounders, pike, and suckers are taken incidentally in the pounds, but these are generally thrown away. In 1889 the pound nets in Baker's Bay made an average daily catch of about five shad to a net. These were generally returned alive to the water after the pound was lifted.

In the account of the fish-wheel given in the preceding chapter (on apparatus), the method of catching fish by this device was shown. Fish are caught automatically, "pumped out of the river," as Major Jones has graphically stated it. The wheels run night and day; the catch is chiefly at night, and it has been aptly said that those interested have nothing to do at that time but lie in bed and listen to the salmon dropping into the boxes or scows, sounds that can not fail to be cheering to those whose financial success is thereby assured. In the close season and on Sundays, the wheels are lifted, so that the fish can run by them.

An ingenious device has been adopted by the fish-wheel men to transport their catch to the canneries 2 to 5 miles farther down the river. The salmon are tied together in bunches and these are attached to casks and sent down the stream. Each cannery has its private colors for casks. A sharp lookout is kept for these aquatic transports, and, when one is seen and its color made out, a tug or steam-launch starts out to pick it up and bring the fish to the cannery. As many as 1,500 pounds of fish have been floated down at one time in this way.

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* Testimony of Mr. M. J. McKinney before the Senate Committee on Relations with Canada.

The catch of bluebacks, silver salmon, and steelheads by the wheels is proportionately much greater than in the apparatus near the mouth of the river. The inference is that the chinook is much depleted in numbers by the catch in the estuary of the Columbia, and that consequently a smaller proportion of them reach the upper waters or even get as far as the Cascades and Dalles. In addition to the salmon, large quantities of sturgeon are caught, and these are now increasing in commercial value and importance. Occasionally a shad is taken while attempting to ascend the river to seek a spawning ground. Lamprey eels also get into the wheels. The catch of the wheels is sometimes enormous. Mr. G. W. Williams is authority for saying that on one occasion, in June, 1886, the catch of a single fish-wheel in one day was 13,935 salmon, weighing 85,000 pounds. Tons of sturgeon are also taken in a single day.

A few men, who fish chiefly for the fresh-fish market at Portland, and some of the salmon fishermen (after the close of the salmon season) fish for sturgeon with trawl lines. Lamprey eels are used for bait; these are generally found in abundance at the Cascades and Dalles, where they crawl out on the rocks or ledges on the river banks, and also at the falls of the Willamette, near Oregon City, where a few fishermen make a business of taking eels and salting them for sturgeon bait. The trawls are hauled at stated intervals.

The Chinese variety of trawl is not baited. It is set about 8 inches to 3 feet above the bottom of the river, so that the hooks may intercept the fish that are nosing about in the vicinity. When a sturgeon comes in contract with one of the sharp pointed hooks it quickly enters his body; stung by the pain, he naturally struggles to free himself, and soon he is impaled with other hooks and finally wound up in the gear and rendered helpless. The struggles of one fish usually result in catching others that may be near, for as he surges the trawl about he is almost certain to fasten the hooks into some other sturgeon.

Clam-digging is followed by 12 Indians who work at Clatsop Beach and produce about 1,800 or 1,900 bushels annually. In 1888 they sold 1,872 bushels. As many more were dug by people living near the beach, making a total of 3,744 bushels, worth $4,992. Clams are ordinarily sold in boxes holding about 1¼ bushels, and the regular price per box is $2.

Dangers, loss of life, etc.—Nowhere else in the region between San Diego and Puget Sound do the coast fishermen encounter such dangers or meet with such loss of life as on the Columbia. At times the disasters have been appalling, and on the average they exceed all similar losses on the coast within the limits mentioned. The most disastrous season was in 1880, when the fleet of boats was suddenly overtaken by a gale when near the mouth of the river; sails were blown away, some boats were swamped, and others driven helplessly into the breakers, from which there was no rescue. Sixty lives were lost. The average loss of life is about fifteen annually; but there has been a very gratifying and marked decrease in this particular in recent years, due chiefly to the efforts of the Life-Saving Service.

There is a station of the U. S. Life Saving Service at Cape Disappointment, and during the season many fishermen are rescued from peril, who would otherwise lose their lives. One of the surfmen is continually on the lookout on the mountain side facing the ocean and the river mouth. If a vessel or boat is seen in danger a gun is immediately fired for the purpose of notifying the men at the station, in Baker's Bay, at the base of the mountain. When the gun is heard the boat is immediately launched and manned and proceeds to the rescue. With few exceptions, not only the lives of the fishermen but their nets and boats also have been saved, which otherwise would have been destroyed or would have drifted out to sea beyond recovery.

In 1888, 14 gill-net fishermen and 4 who were engaged in operating pound nets lost their lives between Kalama and the outer bars of the Columbia. Most of the boats, however, were picked up, only three being reported as a total loss.

Damage caused by seals and sea lions.—Seals and sea lions are quite numerous in the estuary of the Columbia, and frequently ascend some distance up the river. They are reputed to be very destructive to salmon, particularly those that have been meshed in gill nets, and they do much damage to drift nets and pound nets. There are daily taken from gill nets many salmon with their heads gone, or a large piece bitten out of their throats, the most dainty morsel and one which these aquatic freebooters covet and generally secure. Frequently these animals get tangled in a net, and in their struggles for freedom they seriously injure the apparatus. Sometimes seals and sea lions are caught in the pound nets.

Extent of the salmon fishery, past and present.—The history of the salmon fishery of the Columbia River, if it could be given in detail, would be one of the most interesting chapters that could be compiled on the fisheries of the world. Notwithstanding the brief existence of this fishery as a commercial enterprise, its record is most remarkable. Less than 25 years ago (in 1866) the piscatorial wealth of this noble stream was practically unknown to the world; now the name of "Columbia River salmon" is a household word all over the civilized globe. It has met with welcome and recognition everywhere, and has given world-wide renown to this section of our country. It is possible here, however, to take only a brief glance at the more noticeable points of historical interest, for space will not permit that full discussion which tempts the pen.

Commercial fishing on the Columbia dates from 1861. In that year H. N. Rice and Jotham Reed began packing salted salmon in barrels at Oak Point, 60 miles below Portland. They used one net 50 fathoms long and 3 fathoms deep, with an 8-inch mesh. This was made of

PLATE XXXIX.

SALMON CANNERY IN BAKER'S BAY, WITH POUND NETS IN DISTANCE.

twine that Mr. Nice spun on an old-fashioned spinning wheel, from flax thread purchased from the stores in the vicinity. The first season's pack amounted to 600 barrels. These met with a limited demand, but sold for $12 per barrel. In 1862, 800 barrels were packed; in 1863, 1,000 barrels, which sold for $10 per barrel; in 1864, 1,800 barrels, at $11; and in 1865 the firm packed 2,000 barrels, but this year a number of other firms engaged in this business, the market was overstocked, and prices fell to $6 per barrel. There is no available record of the pack of these firms in succeeding years, and nothing definite can be learned concerning their continuance in the business. The presumption is that many of them hastily abandoned the enterprise as unprofitable. In these early years the fish were caught almost wholly by Indians, who were usually paid about $40 per month.

The causes which led up to the establishment of salmon canning on the Columbia have been given at length in the discussion of the fisheries of the Sacramento and San Joaquin Rivers. Mention was made there of the building of the first cannery on the Columbia, at Eagle Cliff, in 1866. Then the river literally swarmed with salmon; the wealth of fish was bewildering and the supply seemingly inexhaustible. Nets were made as Nice had made his, and Indians were set at work fishing. The pack was 4,000 cases the first year, 18,000 the next, and 28,000 in 1868.

These were golden years for the pioneers in the trade, for fish could be bought for from 10 to 20 cents, and canned salmon sold at high prices, $14 to $16 per case (of 48 1-pound cans) often being obtained. But competition soon stepped in, and with an increased output new markets had to be sought. The great problems, therefore, which confronted the canners at this time were, first, how to build up a wider demand for their products, and second, how to improve their facilities for packing. Progress was rather slow, but the foundation for the business was solid and the superstructure gradually and surely attained important proportions. For some time, however, the crude and expensive methods of packing continued in use. But, after several years, "Yankee ingenuity" triumphed; improved appliances and methods were introduced, including the use of steam, retorts, etc., and the business was correspondingly improved.

In 1868 the second cannery was built (near Eagle Cliff) by one of the Humes. From that date the establishment of new canneries and the increase in boats, apparatus, etc., were constantly recurring events until the river was literally filled with devices for the capture of salmon, and it finally became apparent that the supply of fish was decreasing to an alarming extent. The assistance of artificial propagation was invoked, but before the results of this could be realized some of the canners transferred their plants from the Columbia to Alaska, where new and prolific fields awaited their enterprise. Still, the industry on the river is of great importance, as the statistics will show, and, with the aid that fish-culture can give, we may look forward to its continuance and improvement in the future.[*]

A recent feature of the salmon fishery, which will be mentioned elsewhere in greater detail, is the development of the trade in fresh salmon for market supplies. This has grown to large proportions.

The change in the salmon fishery (so far as a supply of fish is concerned) may, perhaps, best be shown by the change in price paid the fishermen. At first the price per "count" salmon was 10 cents, and per case $8 to $14. In 1888 and 1889, the price per salmon was $1.25, and per case $6. Of course much of this disparity between the price paid for fish and that received for canned goods is due not only to a scarcity of salmon, but also to improvements in manipulating the products. It would not otherwise be possible to sell manufactured goods at a reduced price when the raw material costs ten or twelve times as much as formerly.

The prices of canned salmon have been subject to much fluctuation. Sometimes the supply has exceeded the demand, and weak holders have cut prices in order to effect sales and realize on their stock. An instance of this kind occurred in 1878, when the price fell to $1 per dozen cans, or $4 per case. Speculators took advantage of this and bought up nearly all the salmon on the market, after which the price rose to $1.40 per dozen.

The following statistical statement, which has been compiled from data published by Major Jones, presents many points of historical interest in a condensed form. Together with the statements that follow it, the leading features of the salmon-canning industry, from its inception to the present time (1889), are demonstrated. The figures given by Major Jones differ to some extent from those published elsewhere, but he had exceptional opportunities to secure these data, and they have generally been accepted as correct by those engaged in the trade.

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[*] While this report is being prepared news comes that the catch of salmon in the season of 1890 has been much greater than for several years previously. Many, if not most, of the canneries have been oversupplied—at least they could not afford to take all the catch at the prevailing prices—and large quantities of fish have been salted by the fishermen in addition to unusual amounts shipped fresh to all parts of the country, or packed in freezers for future distribution. The pack is reported as being 451,000 cases as against less than 325,000 cases in the previous year, though there were five canneries fewer in operation. It is believed by those competent to judge that this result is directly traceable to artificial propagation at the hatchery on the Clackamas. It is certainly gratifying to all interested in the maintenance of the food supply of the United States, and the continuance of this important industry, that it is within the power of man to increase the supply of fish, and thus to restore what he has been so aggressively active in destroying.

Number of cases of salmon packed on the Columbia from 1866 to 1887, together with value, price per case, price per fish, etc.

Year.	No. of cases.	Value.	Price paid to fishermen per fish.	Selling price per case.	No. of boats.	Cash paid to fishermen during seasons.
			Cents.			
1866	4,000	$64,000	15	$16.00	3	$1,800
1867	18,000	288,000	20	13.00	15	10,800
1868	28,000	392,000	20	12.00	25	16,800
1869	100,000	1,350,000	20	10.00	35	60,000
1870	150,000	1,300,000	20	9.00	50	90,000
1871	200,000	2,100,000	20	9.50	75	120,000
1872	250,000	2,325,000	22½	8.00	100	165,000
1873	250,000	2,250,000	25	7.00	125	187,500
1874	350,000	2,625,000	25	6.50	250	262,500
1875	375,000	2,250,000	25	5.00	300	281,250
1876	450,000	2,475,000	25	4.50	400	337,500
1877	460,000	2,400,000	25	5.20	450	345,000
1878	460,000	2,300,000	25	5.00	550	345,000
1879	480,000	2,640,000	50	4.60	750	720,000
1880	530,000	2,650,000	50	4.80	900	795,000
1881	550,000	2,475,000	60	5.00	1,200	990,000
1882	541,300	2,600,000	75	5.00	1,500	1,217,925
1883	629,400	3,147,000	75	5.00	1,700	1,416,150
1884	620,000	2,915,000	50	....	....	870,000
1885	553,800	2,500,000	75	....	....	1,301,050
1886	448,500	2,135,000	75	....	....	1,009,050
1887	356,000	2,124,000	90	....	....	961,200
Total	7,504,000	45,805,000	....	....	....	11,363,525

In addition to the salmon packed in canneries (which in 1888 amounted to 24,190,724 pounds of round fish, with a value to the fishermen of $1,259,932) 933,331 pounds, worth $44,452, were shipped or sold to markets in a fresh condition, and 1,779 barrels (equal to 355,800 pounds of dressed fish) were salted in brine, these having a value of $14,790. The total product was 25,479,855 pounds, with an aggregate value to producers (or fishermen) of $1,319,174. In addition to the above it is estimated that at least 300,000 pounds of fish (chiefly salmon) are used locally by fishermen and their families, or by others who live on the river between the mouth and The Dalles, and of which no definite account can be obtained. These would have a value of $12,000, and would bring the aggregate up to $1,331,174.

Further details are given in the following tabulation, which shows the extent to which each State is interested in the Columbia River fishing and canning industries.

Table showing the extent of the salmon-canning industry on the Columbia River and the fishery dependent thereon, in 1888.

	Oregon.		Washington.		Total.	
	Number.	Value.	Number.	Value.	Number.	Value.
Canneries	18	$177,057	10	$195,420	28	$372,477
Cash capital		670,000		340,000		1,010,000
Cannery hands	1,037		534		1,571	
Fishermen	2,215		1,180		3,395	
Boats	919	146,235	516	87,680	1,435	233,915
Drift gill nets	821	240,400	465	130,800	1,286	371,200
Set gill nets	797	22,325	860	7,500	1,657	29,825
Seines	2	1,050	23	24,900	25	25,950
Pound nets	49	57,050	56	32,500	105	89,550
Weirs	3	3,000	12	12,200	15	15,200
Stationary fish wheels	17	63,580	8	25,720	25	89,300
Scow fish wheels	7	10,033	7	9,567	14	19,600
Dip nets	60	1,200			60	1,200
Horses employed	5	500	78	7,800	83	8,300
Total pounds of salmon taken	15,826,369	816,876	9,653,486	502,298	*25,479,855	1,319,174
Pounds salted	327,900	13,395	27,900	1,395	355,800	14,790
Pounds canned	14,771,054	769,225	9,419,670	490,607	24,190,724	1,259,832
Cases packed	227,559	1,365,354	144,918	868,508	372,477	2,234,862
Cost of packing, including fish		1,224,443		750,443		2,001,886
Estimated profits of canneries		140,911		89,065		229,976

* Not including 200,000 pounds, valued at $12,000, the estimated quantity of fresh salmon consumed locally on or adjacent to the Columbia River.

The following table shows the nativity and nationality of the fishermen and factory hands in 1888:

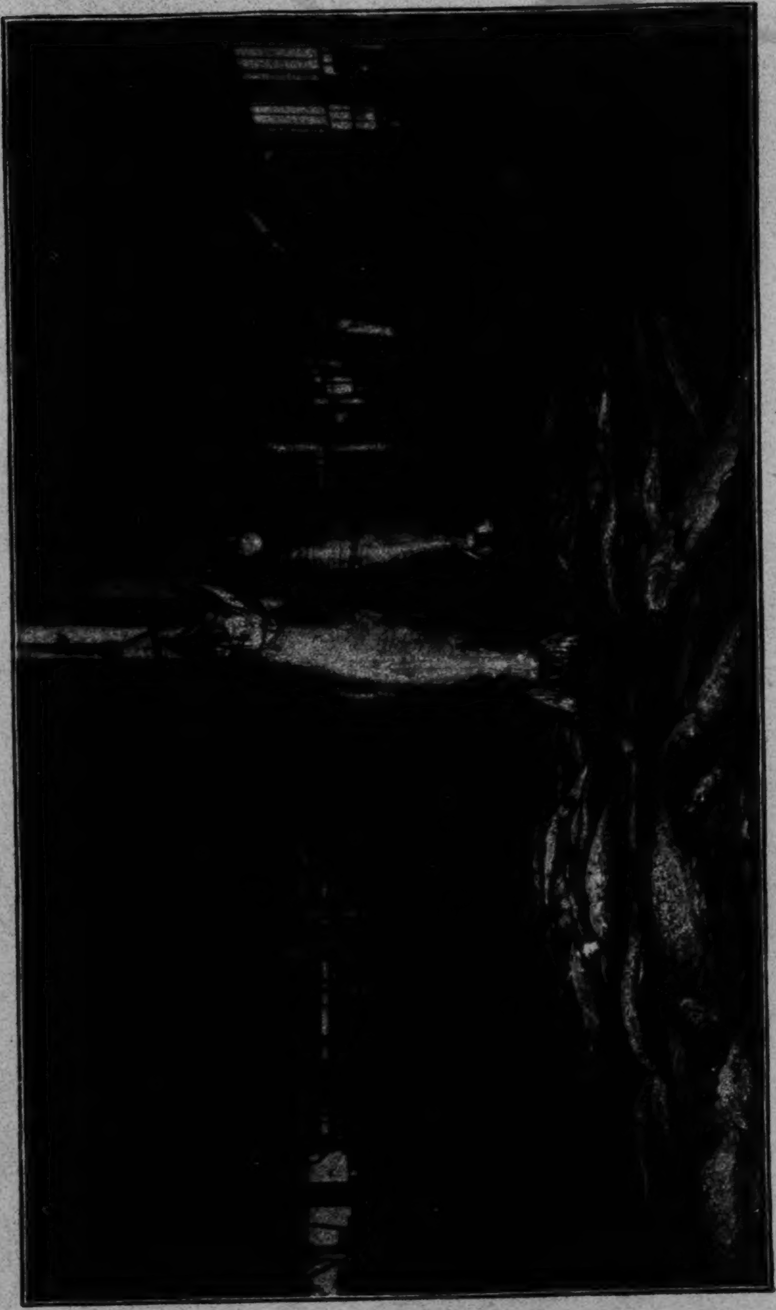
Country.	Fishermen.*		Factory hands.†	
	Nativity.	Nationality.	Nativity.	Nationality.
United States	736	2,486	154	173
United States (Indians)	104	104		
British Provinces	67	34	7	4
Russia	714	280	4	
Austria	240	155	1	
Norway	403	121		
Sweden	932	153	15	5
Greece	132	66		
Germany	47	16	5	
Italy	93	79	1	
Portugal	44	26		
France	4	4	1	1
Denmark	9			
China	13	13	1,383	1,388
	3,538	3,538	1,571	1,571

* These figures include 51 persons employed on small steam vessels in transporting salmon to the canneries.

† The factory hands credited to the United States include 15 women.

As a matter of interest in connection with the salmon industry and the money disbursed in its prosecution, and as a fair illustration of its importance, the following is given on the authority of the Daily Astorian, of Astoria, Oregon, which claims that the statement is a close estimate

PLATE XL.



INTERIOR OF CANNERY.

of the amount of money expended on the Columbia River during the season of 1888:

Items.	Amount.	Items.	Amount.
Material:		Material—Continued:	
Tin plate, 74,000 boxes, at $5.25.	$388,500	Insurance	66,375
Salmon twine	225,250	Hauling	12,540
Cotton twine	25,665	Freight	5,000
Lines	25,000	Labels	53,400
Lead for lines	7,390	Boxes	67,500
Floats	4,000	Taxes	11,400
Boats, wear and tear, paint, repair, etc	22,550	Total cost of material	[illegible]
Tan bark for nets	1,800		
Pig tin for making solder	89,122	Labor:	
Lead for making solder	16,425	Knitting nets, 128,000 fathoms, at 22½ cents	28,800
Salt, Liverpool and coarse	2,065	Catching salmon with cannery boats	[illegible]
Lacquer	5,556	Catching salmon with private nets	[illegible]
Turpentine	6,450	Salvage and hire of detectives	5,700
Cord wood	12,700	White labor outside of fishing	[illegible]
Hard coal	1,222	Other labor outside of fishing	142,000
Charcoal	13,295	Total cost of labor	[illegible]
Acid and zinc	4,000		
Oils of various kinds	4,080		
Improvements and necessary repairs	[illegible]		
Copper and making up	[illegible]		

Salmon canning.—The following account, by Jordan and Gilbert, of the process of salmon canning on the Columbia is as applicable to-day as when written, since there have apparently been no noteworthy changes in this particular in recent years:

> The salmon are brought to the wharf, usually in the morning, counted, and thrown in a heap. A Chinaman then takes each, cuts off its head, tail, and fins, and removes the viscera, throwing them into a large tub. Some of the cutters become very expert and will clean 1,700 fish per day.
>
> Next the fish are washed and sometimes scraped with a knife, though the scales are not removed. Then they are placed in a trough in which several knives acting like a feed-cutter cut the salmon into sections as long as the height of a can. These sections are set on end and split by a Chinaman into about three pieces, one large enough to fill a can, the others smaller.
>
> These fragments are placed on tables and Chinamen there fit them into the cans. Other Chinamen put on the covers, and still others solder them. In some canneries the soldering is done by machinery. In this case the cans are rolled along by an iron chain belt and the end rolls in the melted solder. Most of the canners think hand-soldering safer, although much more labor is required.
>
> After soldering, the cans are placed in hot water and carefully watched to see if any bubbles rise from them indicating a leak in the can. If perfect, the can is placed in an iron tank and boiled in salt water, it being possible to raise salt water to a higher temperature than fresh. After being boiled about one and one-fourth hours the can is taken out and vented, the pressure within driving out all the air through the aperture made. The hole is immediately soldered up, and the cooking completed by again boiling (one and one-half hours) in salt-water kettles. If the process of cooking were completed before the cans were vented, the pressure would be sufficient to burst the cans.
>
> The cans are afterwards tested by being tapped on the head with a large nail. If the can is leaky it gives back a "tinny" sound easily recognized. This is a very

important process, as some canneries lose largely by careless testing, the leaky cans afterwards bursting and damaging more or less the entire box. The cans are usually tested three or four times, and by different workmen. A leaky can is simply sent back to be soldered.

The cans are all made on the premises from sheet tin imported for that purpose. The cost of the tin can is estimated at one-ninth of the cost of the can of salmon.

On an average three salmon fill one case of forty-eight 1-pound cans.—(The Fisheries and Fishery Industries of the United States, section v, vol. 1, page 747.)

Salting salmon.—Curing salmon by salting them in barrels, and having them covered with brine or pickle, is the original method adopted by white men in this region. The fish are split, eviscerated, and washed or soaked sufficiently to make them perfectly clean and free from blood. They are then packed flesh side up and salted. In a few days they are thoroughly "struck" with salt and ready to be packed, repickled, and otherwise prepared for shipment.

Smoking salmon.—A few salmon are smoked. These are first salted sufficiently to preserve them; they are then hung up in a smoke-house—a rough wooden shanty—and smoked for several days over a smudge fire, usually of damp oak. They are then packed in boxes for shipment.

Salting sturgeon.—Sturgeon are salted in brine; they are also salted in bulk or kench and sent East for smoking. In 1888 722 barrels (equal to 144,400 pounds) were pickled and 43,875 pounds were dry-salted.

Freezing fish.—In the fall of 1888 a sturgeon-fishing camp was established by a New York firm at Oneonta, Oregon, in the immediate vicinity of the railway station. This camp was 12 miles below the Cascades and 83 miles, by rail, from Portland. Its proximity to the railroad gave the requisite facilities for shipping its products to the interior or the markets along the Atlantic Coast. The enterprise was started for the purpose of testing the feasibility of shipping fresh frozen sturgeon to distant points. The first shipment was reported to have been made January 16, 1889, and up to May 24 of that year 35 tons of fish had been sent East. This is the first attempt to transport sturgeon in this way from the Columbia. Notwithstanding the high freight rates across the continent, the venture was reported pecuniarily successful during the winter, when sturgeon were scarce in eastern waters. During the summer, however, there is an abundance of eastern-caught or lake sturgeon in the Atlantic or Central States markets, and at this time shipments were not made from Oneonta, except the sturgeon roe, which was salted as caviare and sent East.

The sturgeon used for shipment weighed from 50 to 400 pounds each, for which the price per fish (regardless of size) was 40 cents in 1888-89. They were caught on trawls set near the camp, and also in the salmon wheels a few miles farther up the river. The latter are sent down stream in bunches attached to floats, like the salmon. The fish are first beheaded, eviscerated, and skinned. The backbone is then removed and the flesh cut into suitable sections for freezing. These sections are packed into galvanized iron pans 24 inches long, 16 inches wide, and 5 inches deep. The pans are then put into a freezer charged with ice and salt and their contents are frozen into solid blocks of fish weighing about 60 pounds to each pan. The process is precisely similar to that in vogue on the Great Lakes for freezing fish. When frozen the fish are removed from the pans and packed in boxes—four blocks to each box—and then loaded into refrigerator cars that go direct to New York City. The cars are charged with ice and salt to keep the temperature below the freezing point. In midwinter the cars do not usually require to be recharged before they reach their destination, but when the weather begins to grow warmer in spring it is sometimes necessary to recharge with ice and salt once or more while in transit. Shipments have been reported as arriving in good order. This system of shipping frozen fish will doubtless come into extensive use for transporting salmon.

Secondary products.—Comparatively little effort has yet been made to utilize the waste products of the canneries. A small business is, however, carried on at Astoria, where an attempt has been made to use the refuse of the canneries for the manufacture of oil and fertilizer; but the price paid for the refuse is small, consequently the bulk of the material is dumped into the river. Notwithstanding this, and although the business was conducted in a somewhat primitive manner, enough material was obtained to make 8,000 gallons of oil (chiefly from salmon heads) and 90 tons of fertilizer. The oil was worth 22½ cents per gallon and the fertilizer had a market value of $20 per ton. With proper effort and requisite facilities for collecting the refuse of the canneries along the river, a profitable and extensive business could probably be supported, and much useful material produced from waste that now pollutes the river.

The fish wheels often take in a day many tons of sturgeon less than 50 pounds in weight. Such are not marketable, and are now thrown into the river. Their utilization would be a blessing to the fisherman, for they now help to contaminate the water. Many sturgeon are also taken near the mouth of the Columbia in pound nets, gill nets, etc. Their size and strength often enables them to tear the nets in their efforts to get free. They are, therefore, considered as pests by the fishermen of the lower river, who never save such fish, but generally knock them on the head and throw them back into the water.

The roe of sturgeon is saved to some extent and cured as caviare.

Markets and disposition of products.—The two principal markets and distributing centers on or near the Columbia are Astoria and Portland. From these points most of the fish products of the region are shipped over the United States or sent to foreign countries. Portland consumes a very considerable amount of fresh fish, and, with the exception of sturgeon, the greater part of the fresh products received there is consumed locally.

Astoria is not well provided with fish markets, probably because so many of its people are fishermen and supply themselves with fish.

The following is a statement of the receipts of fish at Astoria, other than those landed at the canneries, during 1888:

Description.	Pounds.
Salmon (fresh)	[illegible]
Salmon (salted in barrels)	[illegible]
Shad (fresh)	[illegible]
Perch (fresh)	[illegible]
Sturgeon (fresh)	[illegible]
Clams ....bushels..	[illegible]

With the exception of salt salmon the foregoing products were consumed locally. It is estimated that fully 100,000 pounds of salmon and other fish in addition to the above are eaten by the fishermen and their families, of which no account can be obtained.

The movements of fish products and their distribution may be understood from the following:

	Lbs.
Fresh salmon shipped from Cascade Locks in 1888, via Pacific Express Co.:	
To points west of the Missouri River	[illegible]
To points east of Missouri	[illegible]
Shipped from The Dalles by the same company:	
Points west of Missouri	[illegible]
Points east of Missouri	[illegible]
Fresh salmon (by express)	[illegible]
Salt salmon (by rail freight)	[illegible]

The "salmon" shipped East in a fresh condition are mostly steelheads, which are much better for market purposes than for canning.

There is a growing demand for canned salmon in the central and eastern portion of the United States, as shown by the shipments, while the direct consignments to England have steadily declined. The Oregonian (Portland, Oregon) of January 2, 1888, stated that the shipments of salmon in cases for three years—1885 to 1887, inclusive—were as follows:

Year.	To San Francisco.*	Eastward.	England.	Total.
1885	[illegible]	†[illegible]	[illegible]	[illegible]
1886	[illegible]	[illegible]	[illegible]	[illegible]
1887	[illegible]	[illegible]	[illegible]	[illegible]

* San Francisco is a distributing center whence salmon are shipped to Australia or other countries.

† Includes [illegible] cases shipped to New York by sail vessels.

The following statistical statements apply to the fisheries of Oregon that are prosecuted on the Columbia River:

Persons employed.

Country.	Fishermen on vessels.		Fishermen on boats.		Shoresmen.		Total.	
	Nativity.	Nationality.	Nativity.	Nationality.	Nativity.	Nationality.	Nativity.	Nationality.
United States	25	29	[illegible]	1,420	102	126	[illegible]	[illegible]
United States (Indians)			[illegible]	84	7	4	[illegible]	[illegible]
British Provinces	1		[illegible]	[illegible]	1		[illegible]	[illegible]
Austria			[illegible]	[illegible]			[illegible]	
Denmark			[illegible]		1	1	[illegible]	[illegible]
France			[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
Germany	2		[illegible]	16			[illegible]	[illegible]
Greece			[illegible]	[illegible]	1		[illegible]	[illegible]
Italy			[illegible]	[illegible]			[illegible]	[illegible]
Norway			[illegible]	[illegible]			[illegible]	[illegible]
Portugal			[illegible]	[illegible]			[illegible]	[illegible]
Russia			[illegible]	[illegible]	4		[illegible]	[illegible]
Sweden	1		[illegible]	[illegible]	15	3	[illegible]	[illegible]
China	2	2	10	10	901	901	913	913
Total	31	31	2,104	2,104	1,037	1,037	3,172	3,172

Apparatus and capital.

Designation.	No.	Value.
Vessels (tonnage, 145.[illegible])	9	$[illegible]
Outfit		7,[illegible]
Boats	1,[illegible]	[illegible]
Seines	[illegible]	[illegible]
Gill nets	1,[illegible]	[illegible]
Weirs and pound nets	[illegible]	[illegible]
Salmon wheels	[illegible]	[illegible]
Minor apparatus		[illegible]
Shore property		[illegible]
Cash capital		[illegible]
Total		1,7[illegible]

Products and values.

Species.	Pounds.	Value.
Fish:		
Salmon, fresh and canned	13,[illegible]	$[illegible]
Salmon, pickled	[illegible]	[illegible]
Brook trout, fresh	12,[illegible]	1,[illegible]
Sturgeon, fresh	[illegible]	11,[illegible]
Sturgeon, pickled	[illegible]	[illegible]
Smelt, fresh	[illegible]	[illegible]
Perch, fresh	[illegible]	[illegible]
Shad, fresh	[illegible]	[illegible]
Eels, salted (bulk)	[illegible]	[illegible]
Tomcod	[illegible]	1,[illegible]
Total	1[illegible]	[illegible]
Miscellaneous:		
Crayfish ... dozen	[illegible]	[illegible]
Clams ... bushels	7,[illegible]	[illegible]
Oil ... gallons	[illegible]	[illegible]
Fertilizer ... tons	[illegible]	[illegible]
Caviare ... pounds	[illegible]	[illegible]
Total		[illegible]
Grand total		[illegible]

42. FISHERIES OF THE WILLAMETTE RIVER.

Geographical characteristics.—The Willamette is formed by the McKenzie River and Middle Fork, which rise in the Cascade range of mountains and unite about 5 miles north of Eugene City, in Lane County. From its confluence the river flows in a northerly direction and forms the boundary line between Linn and Marion Counties on the right, and Benton, Polk, and Yam Hill on the left. Finally it intersects Clackamas and Multnomah Counties and empties into the Columbia River about 12 miles north of Portland, traversing a distance, from the source of the Middle Fork to its mouth, of about 300 miles. The river is navigable as far as Oregon City, 13 miles above Portland, at which town there is an obstruction in the form of falls about 40 feet high. Steam vessels ply on the river from above the falls to Eugene City, about 200 miles above its mouth.

Importance of the fisheries.—The fisheries of this river are confined almost entirely to the pursuit of salmon, although a few barrels of lamprey eels are annually taken at the falls near Oregon City, and salted for use as bait in the sturgeon fishery on the Columbia River.

No account has been made of the fishing on the river between the falls at Oregon City and Eugene City, nor between Portland and the mouth of the river, because in the first instance no commercial fishery is carried on, and in the second case the same men employed on the Willamette also fish on the Columbia, and on account of the intricacy of the problem and slight importance of the industry it is not deemed desirable to separate the catch.

Species, seasons, etc.—The salmon in the Willamette are the same as those in the Columbia. Oregon pike, suckers, whitefish, and lamprey eels also occur. Salmon are the most important species, and, with the exception of a few eels, no other fish are caught. During April and May the catch is confined chiefly to the quinnat salmon, and after that steelheads and bluebacks are caught in greater numbers. In the spring of 1880 the run of salmon was greater than for many years, and during the month of April the catch was larger than for the whole of the preceding year. This abundance was attributed by the fishermen to unusually fine weather and a favorable condition of the water.

Fishing grounds.—The account of the fisheries embraced within this description applies only to the Willamette between Portland and Oregon City, as well as to the fisheries at the mouth of the Clackamas, the same men taking fish indiscriminately in both rivers. From the falls at Oregon City to the source of the stream, no commercial fishing is prosecuted, and while many local species, as trout, Oregon pike, etc., are abundant along the whole length of the stream, no fishing grounds of commercial importance are found. The grounds below Portland as far as the mouth of the river are not considered here, because the men who operate on the Columbia also fish on the lower reaches of the Willamette, and for this reason this section of the river has been mentioned in connection with the fishing grounds of the larger stream.

Disposition of products, etc.—Nearly all of the salmon caught on the Willamette, within the limits under consideration here, are shipped in a fresh condition to Portland, where they are sold for immediate consumption in the markets of that city. The salmon catch is all sent to the Portland markets. A small freighting steamer plying between Portland and the upper river, in addition to its regular business, also at times transports fish from the fishermen along the river to the markets, receiving 2 cents for each fish carried.

Portland as a fish market.—Portland is a beautiful city located on the Willamette, about 12 miles from its junction with the Columbia. It has a population of between 60,000 and 70,000 and is the most important fish market in the region, so far as local consumption is concerned. In addition to the quantities of fresh fish consumed in the city, more or less are shipped by the dealers to the interior towns and to localities along the coast, including San Francisco. Portland is quite a noted railroad center, and naturally it becomes a shipping center for fish (canned, fresh, and pickled) that are sent to the Eastern States. It has considerable capital invested in canneries in Oregon and Washington, a large portion of the pack of which is sent through that city, either for shipment by rail to the Eastern States or for exportation to Europe.

The following tables give some idea of the fish trade of this city:

Quantities and values of the principal species of fish, etc., received at Portland in 1888.

Species.	Pounds.	Value.
Salmon, fresh*	328,732	$[illegible]
Salmon, pickled	65,000	3,[illegible]
Brook trout and salmon trout, fresh	12,500	1,[illegible]
Sturgeon, fresh	173,494	11,976
Sturgeon, salted	186,200	3,724
Smelt, fresh	150,000	3,000
Perch, fresh	2,500	200
Crayfish	14,325	716
Oysters, in shell	150,700	1,751
Total	1,[illegible]	[illegible]

*216,891 pounds came from the Willamette and Clackamas Rivers, and 111,841 pounds from the Columbia.

Monthly shipments of fresh salmon from the Willamette River to Portland, Oregon, in 1888 and 1889.

Month.	1888.		1889.	
	Number.	Pounds.	Number.	Pounds.
April	5,602	101,370	14,305	[illegible]
May	2,645	44,064	2,285	43,[illegible]
June	707	3,484		
October	1,604	77,120		
November	595	6,000		
December	2,427	20,944		
Total	13,170	[illegible]	16,[illegible]	[illegible]

Quantities of fish and oysters forwarded to Portland over the lines of the Oregon Railway and Navigation Company in 1888.

Month.	Sturgeon.		Salmon (fresh).	Smelt (fresh).	Oysters.
	Number.	Pounds.	Pounds.	Pounds.	Sacks.
January	[illegible]	18,745	1,440		
February	1,[illegible]	152,[illegible]	[illegible]	14,250	
March	1,[illegible]	[illegible],410	1,[illegible]	[illegible]	[illegible]
April	[illegible]	[illegible],161	[illegible],945		[illegible]
May	[illegible]	[illegible],175	[illegible],120		[illegible]
June	[illegible]	[illegible],420	[illegible]		
July	[illegible]	[illegible],130	[illegible]		164
August	[illegible]	[illegible],212	[illegible]		
September	[illegible]	[illegible]	[illegible]		[illegible]
October	[illegible]	[illegible],975	[illegible]		[illegible]
November	[illegible]	[illegible],897	[illegible]		
December	207	[illegible]	[illegible]		
Total	[illegible]	[illegible],464	[illegible],421	16,250	1,047

In addition to the above the following quantities of fish, not tabulated by months, reached Portland by the same routes: Salt sturgeon, [illegible] pounds and 710 barrels; salt salmon, 220 barrels.

The following tables show the extent of the fisheries of that portion of the Willamette River included in the preceding discussion:

Persons employed.

Country.	Nativity.	Nationality.
United States	[illegible]	[illegible]
United States (Indians)	16	16
British Provinces	[illegible]	
France	4	4
Germany	2	2
Sweden	10	[illegible]
Total	[illegible]	[illegible]

Apparatus and capital.

Designation.	Number.	Value.
Boats	[illegible]	[illegible]
Gill nets	[illegible]	[illegible]
Total		[illegible]

Products and values.

Species.	Quantity.	Value.
Salmon, fresh ... pounds	[illegible]	[illegible]
Salmon, salted ... barrels	[illegible]	[illegible]
[illegible], salted ... do	[illegible]	[illegible]
Total		[illegible]

IV.—THE FISHERIES OF WASHINGTON.

GENERAL REMARKS.

The fisheries of Washington, while of less extent than those of the other Pacific States, are of great and growing importance. In the salmon and other shore fisheries, and in the canning industry, the State is a formidable rival of Oregon, while its vessel fisheries for fur seals and halibut contribute to the industry of the Puget Sound region. Different phases of the fisheries are shown in the accompanying tables, which include figures for the vessels from New England ports that made their headquarters on Puget Sound in 1888, and really constituted a part of the fishing fleet of this State.

Persons employed in the fisheries of Washington in 1888.

Section.	Fishermen.		Shoresmen.	Total.
	On vessels.	On boats.		
Columbia River	13	1,[illegible]	[illegible]	1,[illegible]
Shoalwater Bay		[illegible]	125	[illegible]
Chehalis River and Gray's Harbor		235	176	413
Puget Sound	270	667	141	1,[illegible]
Total	283	2,571	670	3,[illegible]

Nativity and nationality of persons employed in the fisheries of Washington in 1888.

Country.	Fishermen.		Shoresmen.	
	Nativity.	Nationality.	Nativity.	Nationality.
United States	317	1,[illegible]	194	[illegible]
United States (Indians)	612	612		
British Provinces	40	26	1	1
South America	6	6		
Austria	44	25		
France	2	2		
Germany	13	2		
Greece	[illegible]	30		
Italy	[illegible]	21		
Norway	297	170		
Portugal	25	16		
Russia	280	146		
Sweden	330	135	6	6
China	1	1	[illegible]	[illegible]
Japan	8	8		
Total	2,854	2,854	[illegible]	[illegible]

Apparatus and capital employed in the fisheries of Washington in 1888.

Section.	Apparatus of capture.								
	Gill nets.		Seines.		Weirs and pound nets.		Salmon wheels.		Value of of minor appara-tus.
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	
Columbia River	795	$120,200	23	$24,000	68	$64,700	15	$45,287	
Shoalwater Bay	106	14,850			42	22,000			$416
Chehalis River and Gray's Harbor	170	25,375			27	25,000			
Puget Sound	57	16,620	30	16,200	12	9,000			2,670
Total	1,130	177,245	53	44,200	149	120,400	15	45,287	2,986

Section.	Vessels.				Boats.		Other property.		Total capital invested.
	No.	Net ton-nage.	Value.	Value of outfit.	No.	Value.	Value of land, buildings, accesso-ries, etc.	Cash capital.	
Columbia River	1	64.05	$17,000	$2,000	516	$87,000	$300,220	$140,000	$[illegible], 107
Shoalwater Bay					267	10,425	42,000	35,000	103,140
Chehalis River and Gray's Harbor					95	10,125	44,000	75,000	172,400
Puget Sound	16	698.68	54,000	29,300	414	28,000	42,000	65,000	285,720
Total	17	762.73	71,000	31,300	1,292	135,000	388,220	265,000	1,317,[illegible]

Products of the fisheries of Washington in 1888.

Species.	Columbia River.		Shoalwater Bay.		Chehalis River and Gray's Harbor.		Puget Sound.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Fish.								
Cod, fresh .... pounds							220,400	$10,520
Halibut, fresh .... do							575,000	21,000
Halibut, salted .... do							300,000	10,100
Salmon, fresh .... do	8,725,125	$696,000	1,755,000	$88,000	2,775,000	$88,200	1,039,250	41,085
Salmon, salted .... do	27,000	1,265					150,000	3,410
Other kinds, fresh .... do							2,135,200	28,775
Total	8,752,125	696,265	1,755,000	88,400	2,775,000	88,200	4,[illegible]	120,[illegible]
Mammals.								
Fur-seal pelts .... number							5,331	22,[illegible]
Sea-otter pelts .... do							30	3,000
Total							5,361	25,[illegible]
Mollusks and crustaceans.								
Crabs .... number							7,500	375
Clams .... pounds							500,000	3,750
Oysters .... do			2,270,200	30,374			700,000	21,000
Shrimps .... do							5,000	500
Total			2,270,200	30,374				25,[illegible]
Secondary products.								
Dogfish oil .... gallons							30,000	6,000
Grand total		696,265		118,774		88,200		188,[illegible]

Summary of the products of the fisheries of Washington.

Species.	Quantity.	Value.	Species.	Quantity.	Value.
Fish.			*Other products.*		
Cod, fresh ....pounds..	[illegible]	[illegible]	Fur-seal pelts.....number..	[illegible]	[illegible]
Halibut, fresh ....do....	[illegible]	21,[illegible]	Sea-otter pelts ....do....	[illegible]	[illegible]
Halibut, salted ....do....	[illegible]	[illegible]	Crabs ....do....	7,[illegible]	[illegible]
Salmon, fresh ....do....	18,185,[illegible]	[illegible]	Clams ....pounds..	[illegible]	[illegible]
Salmon, salted ....do....	123,[illegible]	4,[illegible]	Oysters ....do....	4,[illegible]	[illegible]
Other kinds, fresh ....do....	1,136,[illegible]	33,775	Shrimps ....do....	[illegible]	[illegible]
			Dogfish oil........gallons..	[illegible]	4,[illegible]
Total	18,814,[illegible]	[illegible]	Total		137,[illegible]
			Grand total		[illegible]

Statistics of the salmon-canning industry of Washington in 1888.

Location of canneries.	No. of canneries.	No. of factory hands.	Salmon used for canning.		Canned salmon placed on market.	
			Pounds.	Price paid to fishermen.	Cases.	Value.
Columbia River	10	[illegible]	9,410,[illegible]	[illegible]	144,916	[illegible]
Shoalwater Bay	3	185	1,575,000	47,250	22,500	139,375
Gray's Harbor and Chehalis River	4	176	2,775,000	[illegible]	37,000	212,750
Puget Sound	4	141	1,[illegible],200	[illegible]	21,975	[illegible]
Total	21	[illegible]	15,[illegible]	[illegible],771	226,[illegible]	1,[illegible]

45. FISHERIES OF THE COLUMBIA RIVER.

These fisheries have been so fully discussed elsewhere that it is not necessary to further allude to them. In order that the relative importance of the fisheries of the two States may be better understood, however, it is deemed advisable to show in the following tables the extent of the fisheries of Washington on the Columbia.

Persons employed.

How engaged.	No.
Vessel fisheries	11
Shore fisheries	1,[illegible]
Canneries	[illegible]
Total	1,[illegible]

Nativity and nationality of persons employed.

Country.	Fishermen.				Shoresmen.		Total.	
	On vessels.		On boats.					
	Nativity.	Nationality.	Nativity.	Nationality.	Nativity.	Nationality.	Nativity.	Nationality.
United States	12	12	419	1,016	22	22	[illegible]	1,[illegible]
United States (Indians)			[illegible]	[illegible]			[illegible]	[illegible]
British provincials			30	15			30	15
Austria			44	22			44	22
France			3	2			3	2
Germany			6	2			6	2
Greece			48	22			48	22
Italy			6	6			6	6
Norway			214	[illegible]			214	[illegible]
Russia			[illegible]	[illegible]			[illegible]	[illegible]
Sweden			[illegible]	91			[illegible]	[illegible]
China	1	1			[illegible]	[illegible]	483	483
Total	13	13	1,[illegible]	1,[illegible]	[illegible]	[illegible]	1,[illegible]	1,[illegible]

Apparatus and capital.

Designation.	No.	Value.
Vessels (tonnage, [illegible])	3	$17,[illegible]
Outfit		[illegible]
Boats	[illegible]	[illegible]
Seines	22	24,[illegible]
Gill nets	[illegible]	[illegible]
Pound nets	[illegible]	[illegible]
Salmon wheels	15	45,[illegible]
Shore property and accessories		[illegible]
Cash capital		[illegible]
Total		[illegible]

Products and values.

Species.	Pounds.	Value.
Salmon, fresh and canned	9,[illegible]	[illegible]
Salmon, pickled	37,[illegible]	1,[illegible]
Total	9,[illegible]	[illegible]

46. FISHERIES OF SHOALWATER BAY.

This body of water is inclosed on the west by a long, narrow sand spit thrown up by the action of the Pacific tides, extending from the headland of the Columbia River entrance (Cape Disappointment) to Leadbetter Point, at the mouth of Shoalwater Bay. The spit varies in width from ½ to 1 mile, and is about 17 miles long. The bay proper is about 24 miles long, from north to south, and from 3 to 5 miles wide. It is located in Pacific County. The bay is shallow, excepting in the main channel, and in many places extensive sand-bars and mud-flats are to be found. In the southern part, near the eastern shore, is a large islet, known as Long Island. Eight rivers flow into the bay. Bear River is located in the extreme southeastern part of the bay; Naseal River is

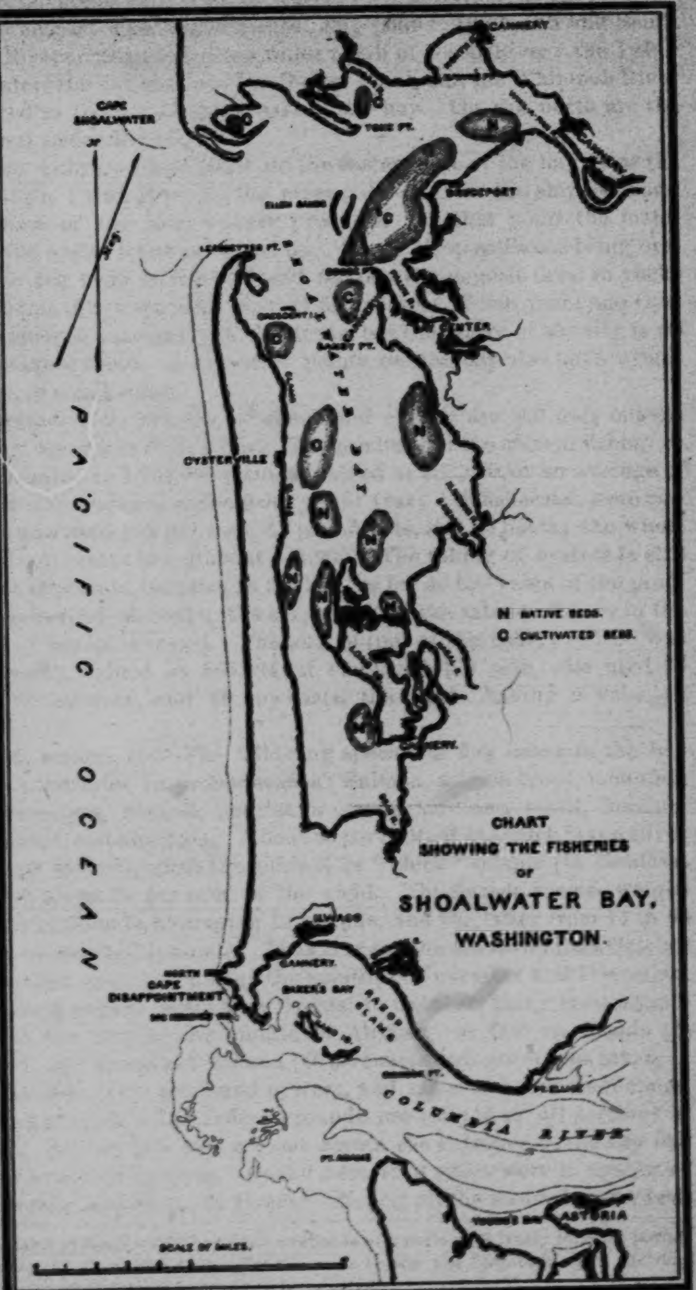

CANNERY
CAPE SHOALWATER
TOKE PT.
BRUCEPORT
LEADBETTER PT.
SANDY PT.
BAY CENTER
SHOALWATER BAY
OYSTERVILLE
PACIFIC OCEAN
N NATIVE BEDS.
O CULTIVATED BEDS.
ILWACO
CANNERY.
NORTH HEAD
CAPE DISAPPOINTMENT
BAKER'S BAY
CHINOOK PT.
COLUMBIA RIVER
PT. ADAMS
YOUNG'S BAY
ASTORIA
SCALE OF MILES.

CHART
SHOWING THE FISHERIES
OF
SHOALWATER BAY,
WASHINGTON.

next on the east side, and opposite Long Island; the North and South Nemur Rivers occur next, a few miles north of Nasal River; the Palux River enters the bay opposite Leadbetter Point, and the Whilapah River is situated in the northeastern part of the bay. On the north are the North and Cedar Rivers.

Fishing centers.—Bay Center, on the eastern side of the bay, near the mouth of the Palux River, is the principal center for the shipment and distribution of the local fishery products. At this point the major part of the oyster trade is carried on. Small sloop-sailboats bring oysters from the beds on the bay and temporarily deposit them in racks and cribs at this town until wanted for market. Some years ago Oysterville enjoyed a monopoly of this trade, but the center of activity is no longer located there. A few other points on the bay also have oyster interests of small value.

Importance of the fisheries.—Salmon and oysters are the only objects of fishery commerce of this bay. The products of the salmon fishery in 1888 amounted to 1,755,000 pounds, valued at $52,650, or an average of $355 per man engaged in the fishery that year; 148 fishermen were employed, who used 108 gill nets, 42 pound nets, and 54 boats; the whole value of apparatus being about $41,000. The taking of oysters is still the most important industry in the bay, so far as the value of the product is concerned, although it is surpassed by the salmon fishery in the amount of capital invested. The total output of this fishery in 1888 was 32,762 sacks, valued at $65,524; it employed 150 men, who used 23 sloops, 61 bateaux, and 49 rowboats, the whole having a value of $14,920.

Species, seasons, etc.—The following species of fish occur in the bay and its tributaries in proper season: Salmon, salmon trout, mountain trout, flounders, tomcod, porgies or perch, sardines, smelt, herring, soles, skates, and sturgeon. About 80 per cent. of the catch is the silver salmon (*O. kisutch*), while the quinnat or "black" salmon (*O. chouicha*) comprises about 20 per cent. of the yield. The former species weighs from 8 to 16 pounds, averaging 12 pounds, and the latter from 14 to 50 pounds, averaging 22 pounds. The silver salmon are found from October to December, spawning during the months of November and December. The quinnat salmon occur from August to October, being most abundant from the first to the middle of August. A few steelheads (*S. gairdneri*) and humpback salmon (*O. gorbuscha*) are sometimes taken.

Of shellfish, there are found oysters, and razor and soft-shell clams.

Fishing grounds.—The fishing grounds are located in all sections of the bay. Salmon gill nets are set across the entrance to the bay and at other available sections. Pound nets, 42 of which were in operation, are generally located in the rivers.* Nearly all the natural oyster beds are in the vicinity of Long Island. The artificial or transplanted beds are on the west side of the bay, near Oysterville, and on the east side, between the mouths of the Palux and Whilapah Rivers. Clams are found at different points along the west shore of the bay.

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* No charts of Shoalwater Bay were available of a scale sufficiently large to permit the location of the pound nets. For the same reason the definition upon the map of many other interesting data had to be omitted.

Fishermen, lay, etc.—The salmon fishermen receive 60 cents apiece for quinnat salmon and 30 to 33 cents each for silver salmon; this is about 3 cents a pound for the fish as they come from the water. The earnings of the oystermen are governed entirely by the quantities taken and the demand in the market.

Apparatus, boats, etc.—The gill nets, pound nets, boats, etc., are essentially the same as those already described for other localities.

Methods.—The methods of fishing for salmon, both by pounds and gill nets, are practically the same as on the Columbia and other points along the coast.

The oyster industry.—Shoalwater Bay is celebrated on the Pacific coast for its oysters, which occur abundantly there on natural beds. For a number of years the oyster supply of San Francisco was obtained solely from this source. Since the eastern oyster was first successfully transplanted to beds in San Francisco Bay, however, the importance of the Shoalwater Bay oyster fishery has steadily declined in about the same ratio as the importation of Atlantic oysters has increased.

The oysters are small, and have a strong flavor that makes them objectionable to an uncultivated taste, but nevertheless they are highly prized by the natives of the coast. The most extensive natural oyster-beds on the west coast are in this bay, mostly in the southern section in the vicinity of Long Island. By referring to the accompanying chart, (plate XLI) it will be seen that a number of cultivated or transplanted beds are marked. The transplanting of oysters from the natural to the cultivated beds has become necessary because the bottom of the bay near the natural beds is rapidly filling up with vegetable growths, and many areas which were once profitable oyster grounds are now worthless. Natural oyster beds are protected by law between June 15 and September 1, during which time the light demand in the markets is supplied from planted beds. Oysters can not be taken from the natural beds during the close season; but private beds can be worked by their owners, and are also protected by law.

In the oyster fishery the methods are somewhat similar to those in vogue in San Francisco Bay. During the warm months oysters are taken by hand from the beds, which are exposed at low tide. In the winter they are gathered chiefly with tongs. While the tide is in, or high, large bateaux are towed to the oyster beds and anchored, where they ground at low tide. The men then gather the oysters from the uncovered beds, and cull and load them on the scows. When there is a sufficient quantity on the craft, they are towed to the home station, where the oysters are unloaded into "live-cars" until ready for market or shipment. Sometimes the bateaux are sailed across the bay with their freight, but commonly they are towed by the oyster sloops if the wind is light.

When the oysters arrive at the shipping point they are transferred to [illegible]rge cars anchored near the dock, and are also put in bins under the [illegible]arves. These bins are so arranged that the water covers the oysters [illegible]ll flood and uncovers at low tide. Oysters are shipped to supply [illegible], and are sent to market in sacks holding about 100 pounds each. [illegible]loop boats employed in the fishery take the catch to the southern en[illegible] bay, where it is transferred by team overland to Ilwaco, on the [illegible]a River, a distance of about 7 miles. Here it is placed on the stea[illegible]storia, whence it is reshipped to Portland, San Francisco, and ot[illegible]ts. There is a railroad between Ilwaco and a point about 3 miles so[illegible] of Oysterville. Were it not for the large freight charges over thi[illegible] the products of the oyster fishery could well reach market in a much less time than is required at present. The fishermen find, however, that the few hours gained by the latter method are not sufficient to compensate for the additional expense.

Salmon canning.—There were four salmon-canning establishments located on Shoalwater Bay and its tributaries in 1888: One at the mouth of North River; one 8 miles inland from the mouth of the Whilapah River; another at Bay Center on the Palux River; and the fourth at the southern extremity of Long Island. The last-mentioned establishment was idle in 1888, although operated in 1887. The three canneries packed 22,500 cases in 1888.

The statistics of the fishery industry of Shoalwater Bay in 1888 are as follows:

Persons employed.

Country.	Fishermen.		Factorymen.	
	Nativity.	Nationality.	Nativity.	Nationality.
United States	144	168	15	15
United States (Indians)	113	113		
Russia	10	9		
Sweden	17	6		
China			110	110
Norway	9			
Germany	3			
	296	296	125	125

Apparatus and capital.

Designation.	No.	Value.
Boats	187	$19,415
Pound nets	43	22,000
Gill nets	165	14,850
Oyster tongs	175	875
Shore property		*55,000
Cash capital		55,000
Total		167,140

* Including $12,000, the value of a salmon cannery temporarily idle in 1888.

Products.

Species.	Quantity.	Value.
Salmon .... pounds..	[illegible]	[illegible]
Oysters .... do.....	[illegible]	[illegible]
Total	[illegible]	118,174
Salmon canned .... cases..	22,500	[illegible]

47. FISHERIES OF GRAY'S HARBOR AND CHEHALIS RIVER.

Gray's Harbor is located between 46° 02′ and 47° 02′ north latitude, and 123° 50′ and 124° 10′ west longitude. It is the second largest bay on the coast northward from Cape Disappointment, and affords an excellent harbor. Unlike Shoalwater Bay, it receives quite a large river (Chehalis), the main and eastern branch of which has its source in the westernmost flank of the Cascade Range, while another tributary rises near Olympia, at the head of Puget Sound. There are several smaller branches which stretch behind Shoalwater Bay and reach within 12 miles of the Columbia River.

The harbor is divided into two parts, known as North and South Bays. John's Bay is a small body of water inclosed on the west and south by a sand spit which forms Point Brown, the northern headland of the bay. The Chehalis River empties into the harbor directly east from the entrance of the bay. In addition to the Chehalis there are the Neuskahl, John's, and Elk Rivers on the south shore, and Kishkah, Hoquiam, and Humptulupus Rivers, and Chenois Creek on the north side.

Until recently the harbor was of little importance commercially, and attracted but slight attention. At present, however, it is coming into prominence and many new towns are being located on the shores of the harbor and Chehalis River, among which may be mentioned Hoquiam, a village of several hundred inhabitants at the mouth of the river; Aberdeen, 2 miles above, with 1,300 people; and Montesano, 13 miles up the Chehalis River, with a population of 1,500. Each of these has practically sprung into existence in the last 5 years, the rapid growth of the region being due to the stimulating influences of existing and projected lines of steamboats and railroads.

Fishing centers.—There are no fishing centers of importance on the bay. Aberdeen is, perhaps, the principal center, because of the location of two canneries there, and Montesano has one canning establishment. But while neither has attained marked prominence, they doubtless have important possibilities for the future.

Importance of the fisheries.—There is no commercial fishing in this region except during August, September, October, and November, when salmon are captured to supply the packing establishments. Aside from salmon, the only fishery interests are those maintained on a small

Report U. S. F. C. 1888.—(To face page 240.) Pacific Coast Fisheries.

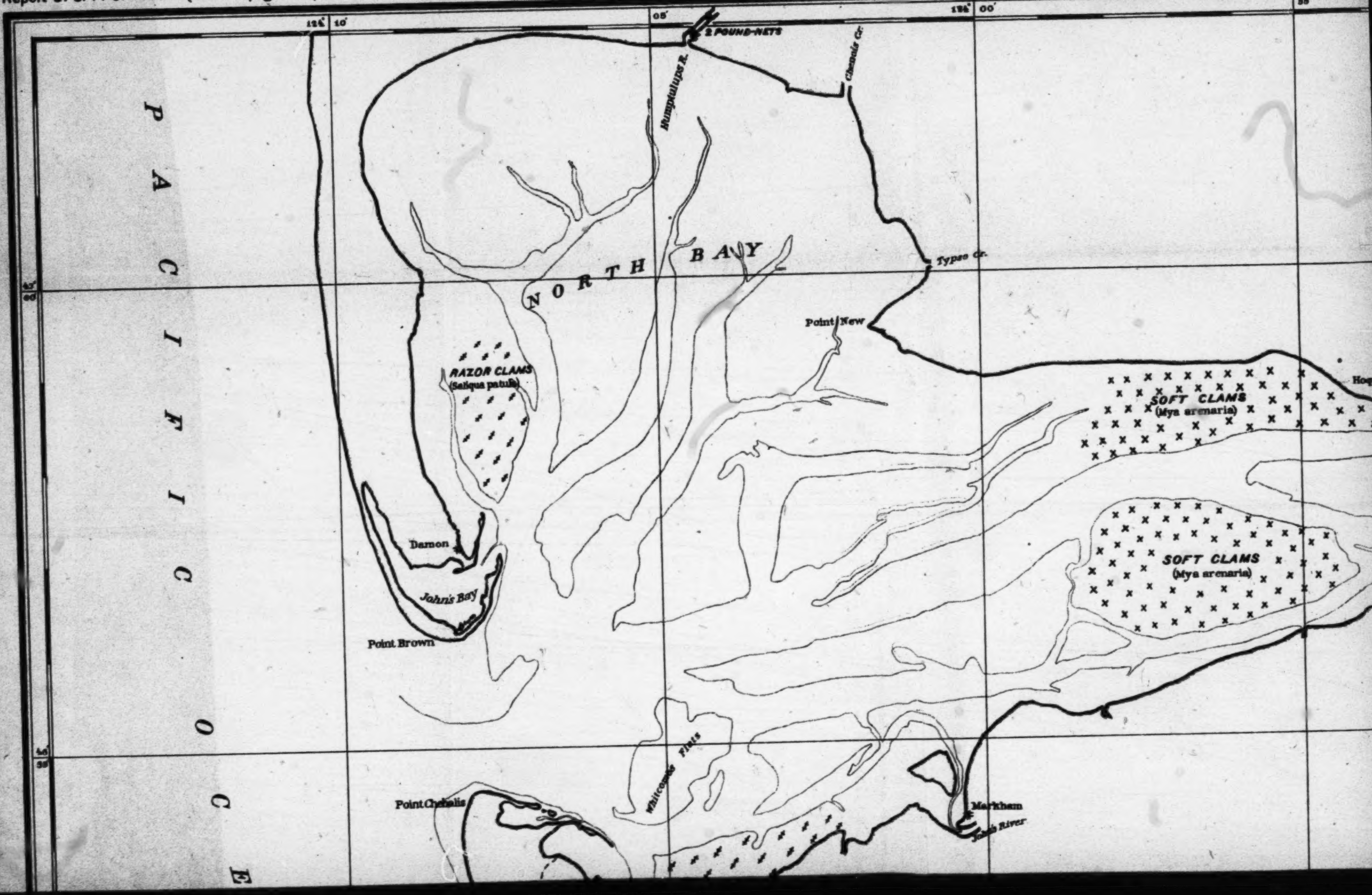
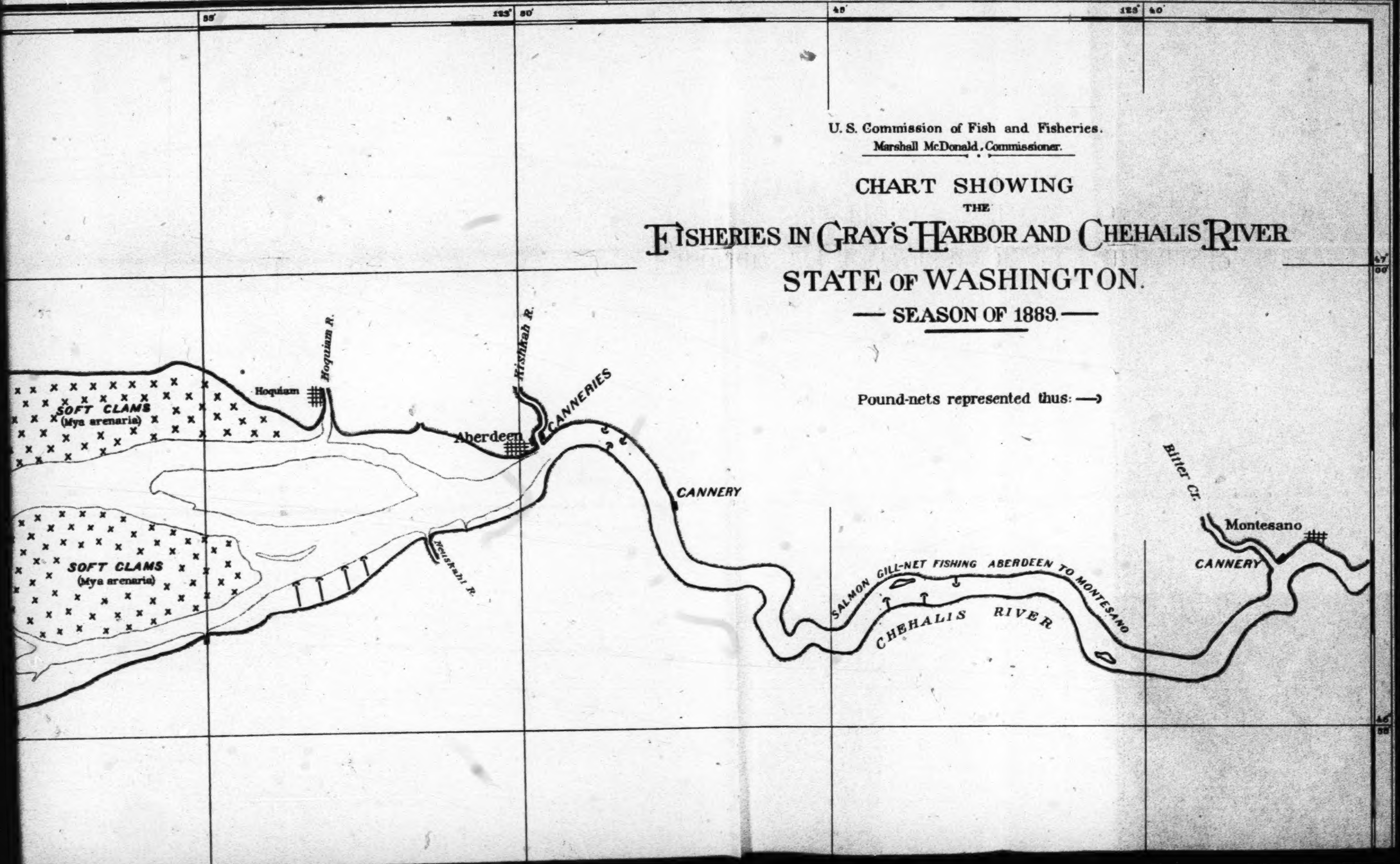

124° 10'
05'
124° 00'
55'
47° 00'
46° 55'
PACIFIC OCEAN
2 POUND-NETS
Humptulups R.
Chenois Cr.
NORTH BAY
Typso Cr.
Point New
RAZOR CLAMS
(Siliqua patula)
SOFT CLAMS
(Mya arenaria)
SOFT CLAMS
(Mya arenaria)
Hoqu
Damon
John's Bay
Point Brown
Whitcomb's Flats
Point Chehalis
Markham
John's River

PLATE XLII.

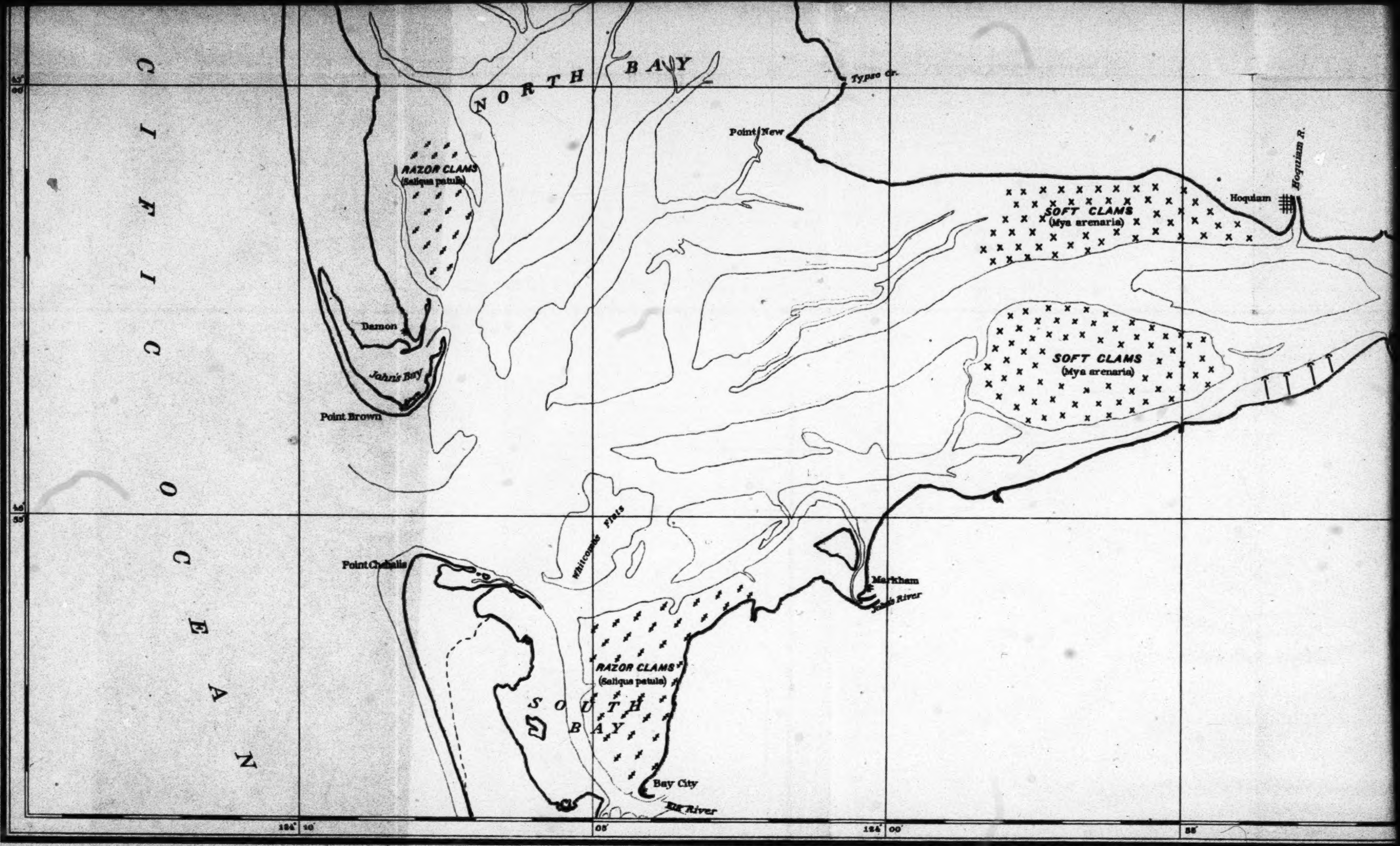


U. S. Commission of Fish and Fisheries.
Marshall McDonald, Commissioner.

CHART SHOWING
THE
FISHERIES IN GRAY'S HARBOR AND CHEHALIS RIVER
STATE OF WASHINGTON.
— SEASON OF 1889. —

Pound-nets represented thus: ⟶

55'
123° 50'
45'
123° 40'
47° 00'
46° 55'
SOFT CLAMS (Mya arenaria)
SOFT CLAMS (Mya arenaria)
Hoquiam
Hoquiam R.
Wishkah R.
Aberdeen
CANNERIES
CANNERY
Weiskah R.
SALMON GILL-NET FISHING ABERDEEN TO MONTESANO
CHEHALIS RIVER
Bitter Cr.
Montesano
CANNERY

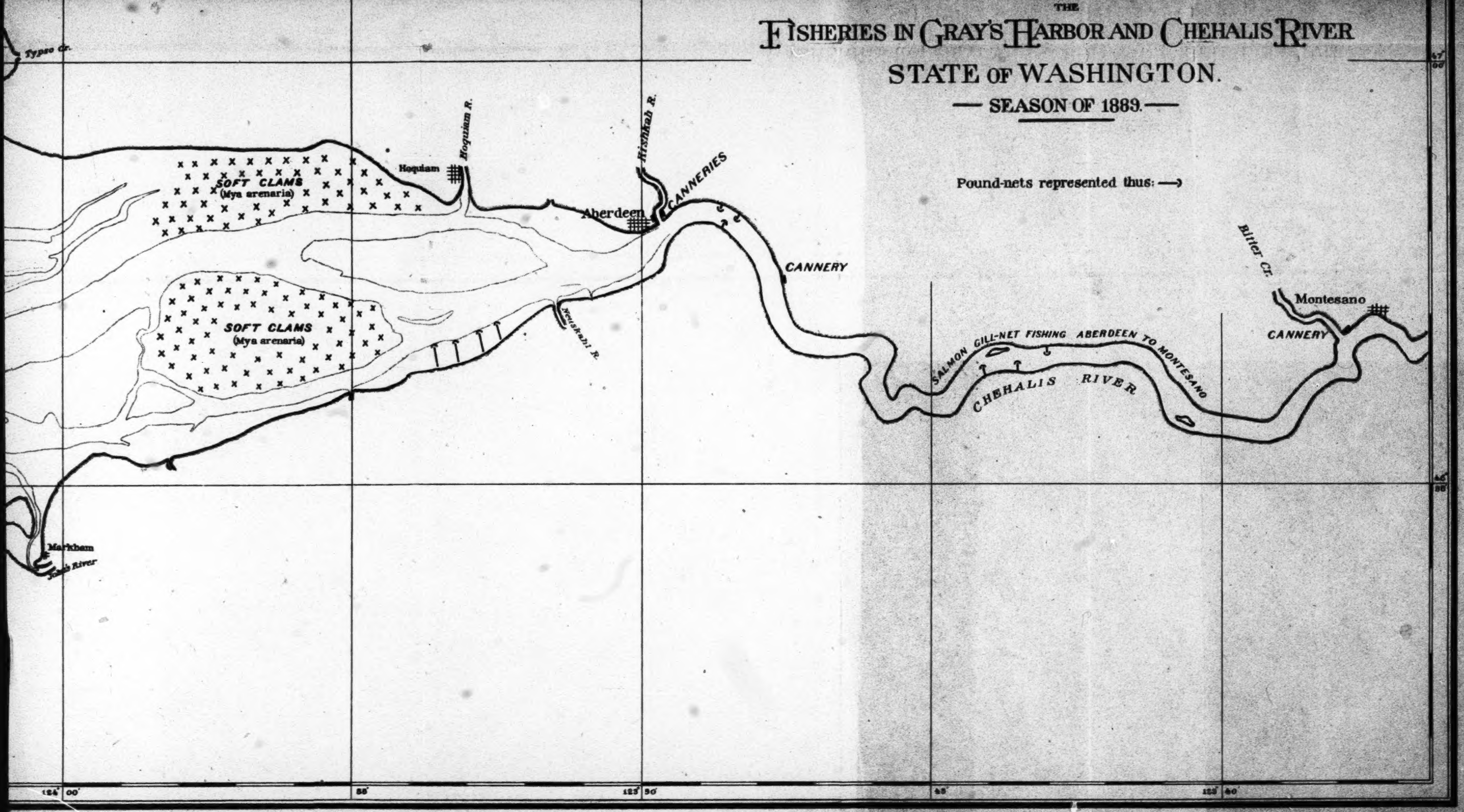

C I F I C O C E A N
N O R T H B A Y
S O U T H B A Y
RAZOR CLAMS (Saliqua patula)
SOFT CLAMS (Mya arenaria)
SOFT CLAMS (Mya arenaria)
RAZOR CLAMS (Saliqua patula)
Typso Cr.
Point New
Hoquiam
Hoquiam R.
Damon
John's Bay
Point Brown
Point Chehalis
Whitcombs Flats
Markham
John's River
Bay City
Elk River
47° 00'
46° 55'
124° 10'
05'
124° 00'
55'

THE

FISHERIES IN GRAY'S HARBOR AND CHEHALIS RIVER

STATE OF WASHINGTON.

— SEASON OF 1889. —


Pound-nets represented thus:
Typso Cr.
Hoquiam
Hoquiam R.
Wishkah R.
CANNERIES
Aberdeen
SOFT CLAMS (Mya arenaria)
SOFT CLAMS (Mya arenaria)
CANNERY
Newskah R.
Bitter Cr.
Montesano
CANNERY
SALMON GILL-NET FISHING ABERDEEN TO MONTESANO
CHEHALIS RIVER
Markham
John's River
124° 00'
55'
123° 50'
45'
123° 40'
47° 00'
46° 55'

only by a few straggling Indians, who occasionally bring fish into the villages; but the variety and abundance of fish, and the fast-growing towns not far distant afford a prospective opportunity to establish a profitable fish trade.

Species, seasons, etc.—Three varieties of salmon frequent Gray's Harbor, the quinnat, silver, and steelhead. The quinnat salmon is present from July until October; the silver from about the middle of September until November, and the steelhead from December until May. In addition to salmon, there are salmon trout, mountain trout, perch, tomcod, sturgeon, sardines, and several species of the *Catostomidæ*. On the banks outside the harbor are caught orange rock-cod (*Sebastichthys pinniger*), red rock-cod (*S. ruber*), halibut, etc. Two varieties of shellfish are also very abundant on the mud flats—the eastern soft-shell clam (*Mya arenaria*) and the razor clam (*Siliqua patula*).

Fishing grounds.—The gill-net grounds are mostly in the various channels of the bay and in the river. Pound nets are located at several points, the greatest number being along the river between Aberdeen and Montesano. The deep-sea banks are located outside the harbor heads about 10 miles offshore, in a northwesterly direction from the whistling buoy off the entrance.

Capt. John Reed reported that often when waiting outside the harbor, to tow vessels in, on or near the fishing bank, he has caught a fine lot of fish. Frequently halibut are taken, and on one occasion 22 were caught in a few hours' fishing with hand lines over the rail; the largest weighed 87 pounds. There is a depth of 30 fathoms of water on the bank, with a gravelly and rocky bottom.

Soft clams are found in abundance on beds on both sides of the river's mouth west of Hoquiam. Razor clams occur in the mud flats in North and South Bays.

Fishermen, etc.—In the fall a number of fishermen from the Columbia River go to the Chehalis to fish for the canneries there. The gill-net fishermen of the river are mostly foreigners, but the men who tend the pound nets are chiefly Americans.

Apparatus and boats.—The apparatus employed in the fisheries of Gray's Harbor consists of pound nets and drift gill nets. Owing to the fact that the early run of salmon in the harbor and river is composed of individual fish of nearly double the size of those constituting the fall run, two kinds of nets are required. Pound nets of a very expensive type are in use on the Chehalis River. Their average value in 1888 was $700. The number employed that year was 37, so that the capital invested in pound nets alone was nearly $26,000. Two kinds of boats are employed in the fisheries. The majority are of the flat-bottomed, sharpy type; a few of the Columbia River salmon-boat style are also used.

Disposition of the products.—All the salmon captured in the bay and river in gill nets and pounds are utilized at the packing establishments for canning purposes. Other species are not sought. There is some desultory fishing by Indians.

Salmon canning.—There are four canning establishments located on the river: Two at Aberdeen, one a few miles above that town, and the fourth at Montesano. In 1888 the four factories gave employment to 176 factory hands and utilized 2,775,000 pounds of fresh salmon, valued at $83,250, the canned product aggregating 37,000 cases.

The following tables exhibit the extent of the fisheries of this region in 1888:

Persons employed.

Country.	Fishermen.		Factorymen.	
	Nativity.	Nationality.	Nativity.	Nationality.
United States	105	152	21	21
United States (Indians)	15	15		
Norway	12	9		
Russia	62	39		
Sweden	42	21		
China			155	155
Total	236	236	176	176

Apparatus and capital.

Designation.	No.	Value.
Boats	55	$10,125
Pound nets	37	25,900
Gill nets	170	23,375
Shore property		44,000
Cash capital		70,000
Total		173,400

Products and values.

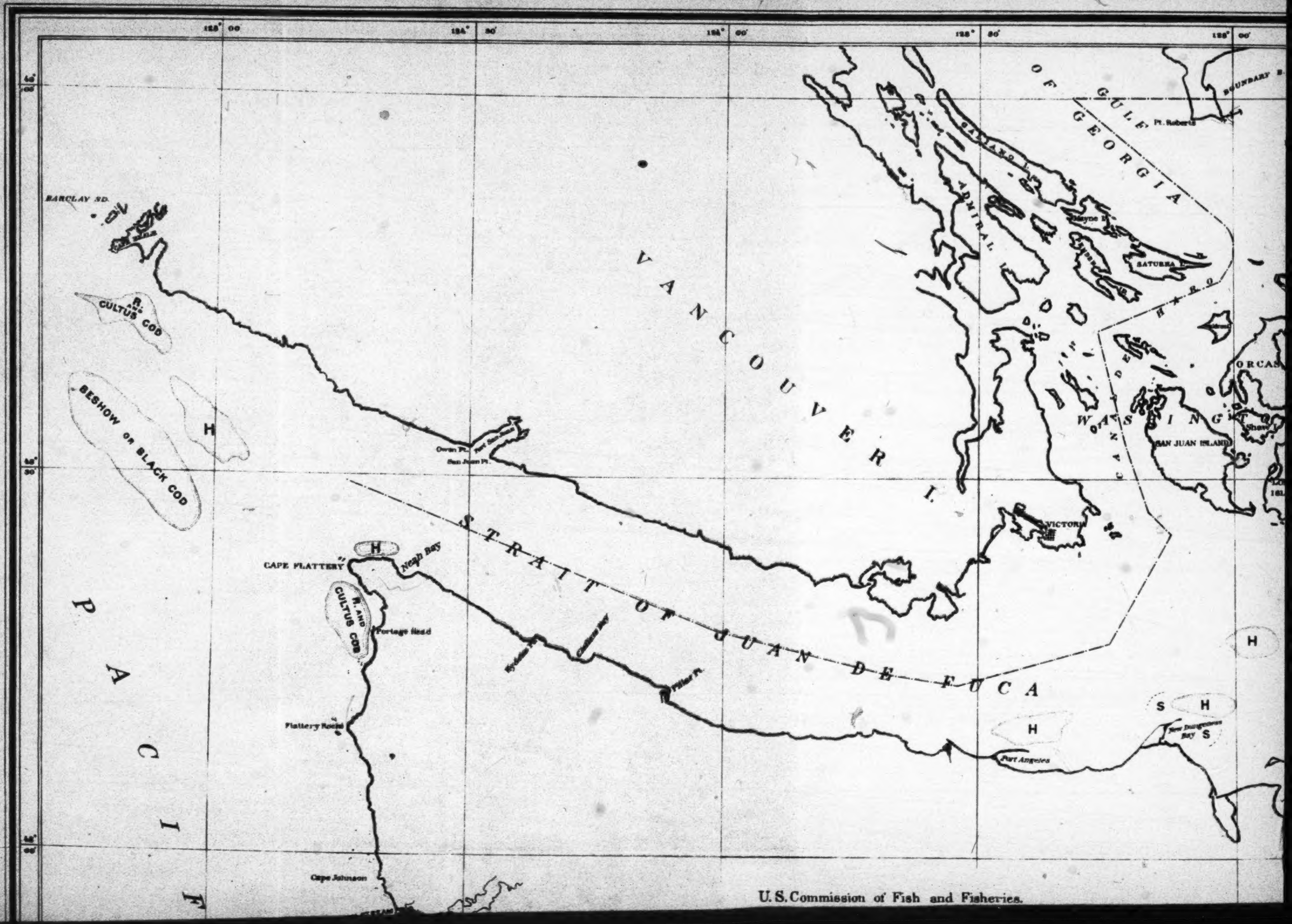
Species.	Quantity.	Value.
Salmon ... pounds	2,775,000	$83,250
Salmon, packed ... cases	37,000	212,750
Total		296,000

48. FISHERIES OF THE QUINIAULT RIVER.

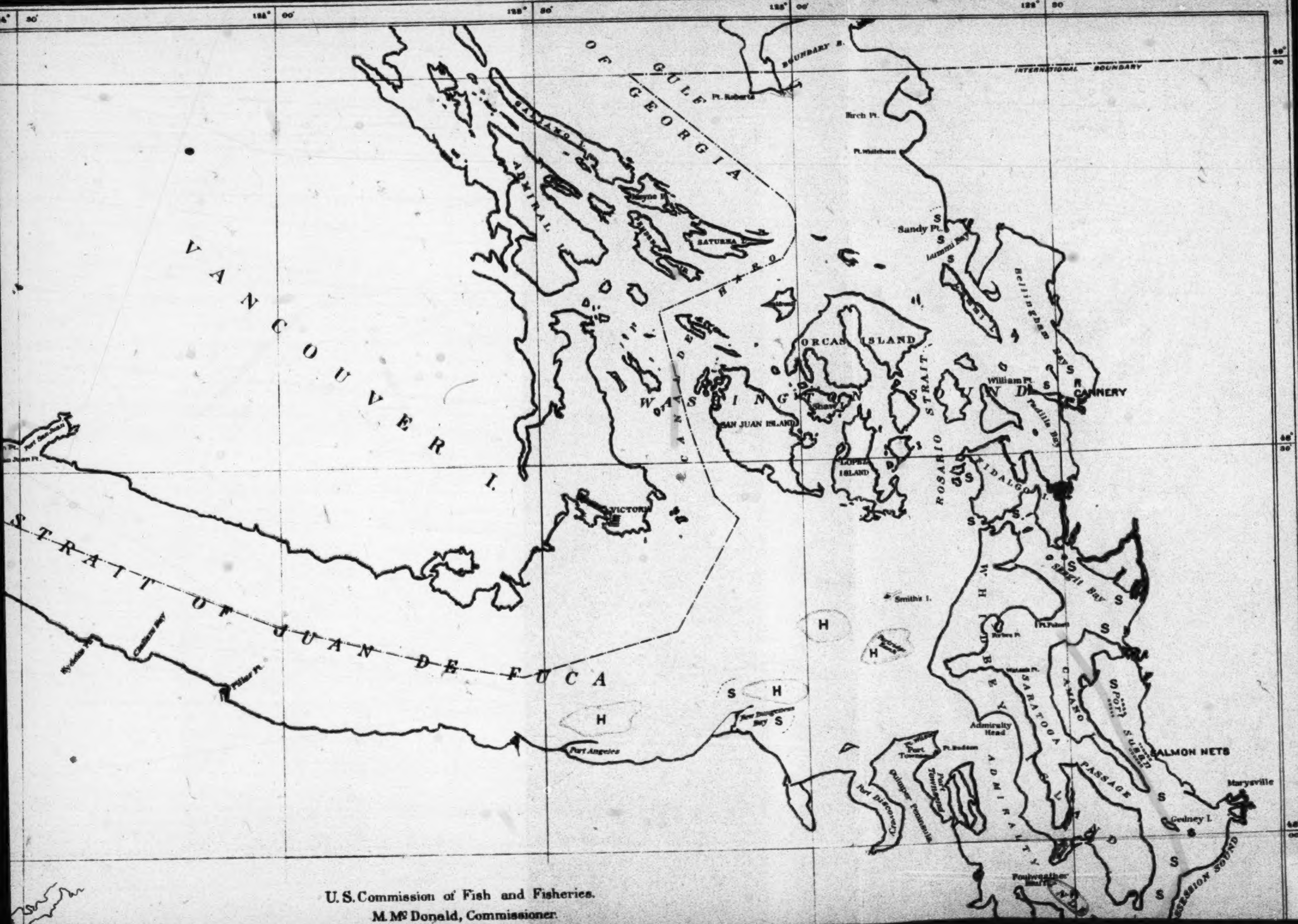
This small stream is in Chehalis County, and empties into the Pacific 3 miles northwest from Point Grenville and 1 mile east of Cape Elizabeth. It abounds in salmon of several varieties which begin to run in January and continue until the latter part of November. The first run is said to be that of the quinnat salmon, but it is more than probable that the species is the blueback (*O. nerka*). The salmon which appear in the fall are known as the "black salmon," which, on account of their size, are thought to be the quinnat.

The river is included within the precincts of the Quiniault Indian

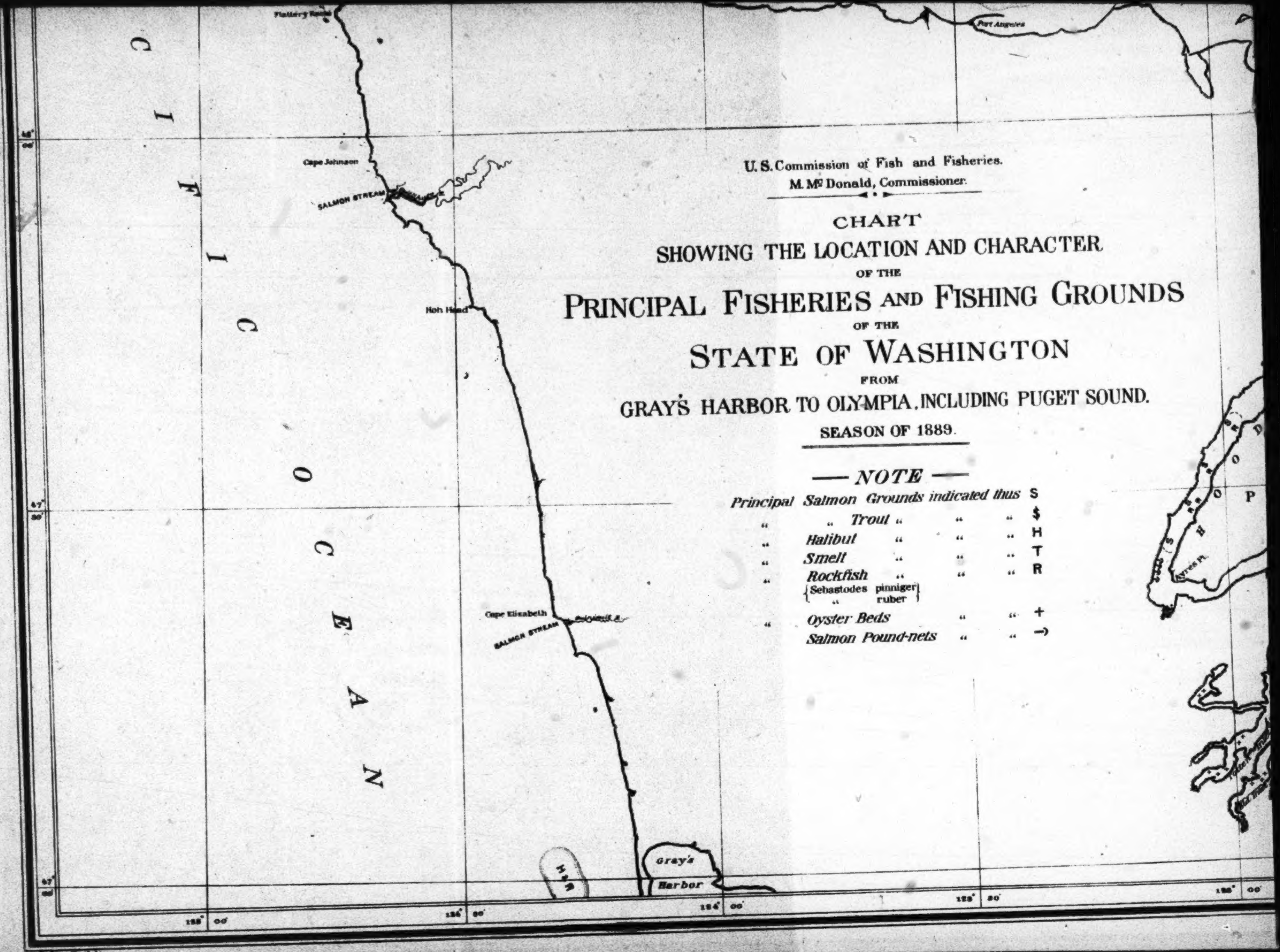
Report U. S. F. C. 1888.—(To face page 243.) Pacific Coast Fisheries.


125° 00'
124° 30'
124° 00'
123° 30'
123° 00'
49° 00'
48° 30'
48° 00'
BARCLAY SD.
R. AND CULTUS COD
BESHOW OR BLACK COD
H
VANCOUVER I.
Owen Pt.
Port San Juan
San Juan Pt.
STRAIT OF JUAN DE FUCA
CAPE FLATTERY
Neah Bay
R. AND CULTUS COD
Portage Head
Flattery Rocks
Cape Johnson
Pillar Pt.
PACIF
GULF OF GEORGIA
Pt. Roberts
BOUNDARY B.
GALIANO I.
ADMIRAL I.
Mayne I.
SATURNA I.
HARO
DE HARO
CANADA
WASHINGTON
ORCAS
Shaw I.
SAN JUAN ISLAND
VICTORIA
S
New Dungeness Bay
Port Angeles

U.S. Commission of Fish and Fisheries.


124° 30'
124° 00'
123° 30'
123° 00'
122° 30'
49° 00'
48° 30'
48° 00'
GULF OF GEORGIA
BOUNDARY B.
INTERNATIONAL BOUNDARY
Pt. Roberts
Birch Pt.
Pt. Whitehorn
Sandy Pt.
Lummi Bay
Lummi I.
Bellingham Bay
GALIANO I.
ADMIRAL I.
Mayne I.
SATURNA I.
HARO
CANAL DE HARO
VANCOUVER I.
WASHINGTON SOUND
ORCAS ISLAND
Shaw I.
SAN JUAN ISLAND
LOPEZ ISLAND
ROSARIO STRAIT
FIDALGO I.
William Pt.
CANNERY
Padilla Bay
VICTORIA
Port San Juan
San Juan Pt.
STRAIT OF JUAN DE FUCA
Clallam Bay
Pillar Pt.
Port Angeles
New Dungeness Bay
Smiths I.
WHIDBEY I.
Skagit Bay
SARATOGA
CAMANO
PASSAGE
PORT SUSAN
SALMON NETS
Marysville
Gedney I.
POSSESSION SOUND
Admiralty Head
Port Townsend
Pt. Hudson
Quimper Peninsula
Port Discovery
ADMIRALTY
Foulweather Bluff
S
H

U.S. Commission of Fish and Fisheries.
M. McDonald, Commissioner.


Flattery Rocks
Port Angeles
C
I
F
I
C
O
C
E
A
N
Cape Johnson
SALMON STREAM
Hoh Head
Cape Elisabeth
SALMON STREAM
Gray's
Harbor
Ayres Pt.
P
48° 00'
47° 30'
47° 00'
125° 00'
124° 30'
124° 00'
123° 30'
123° 00'

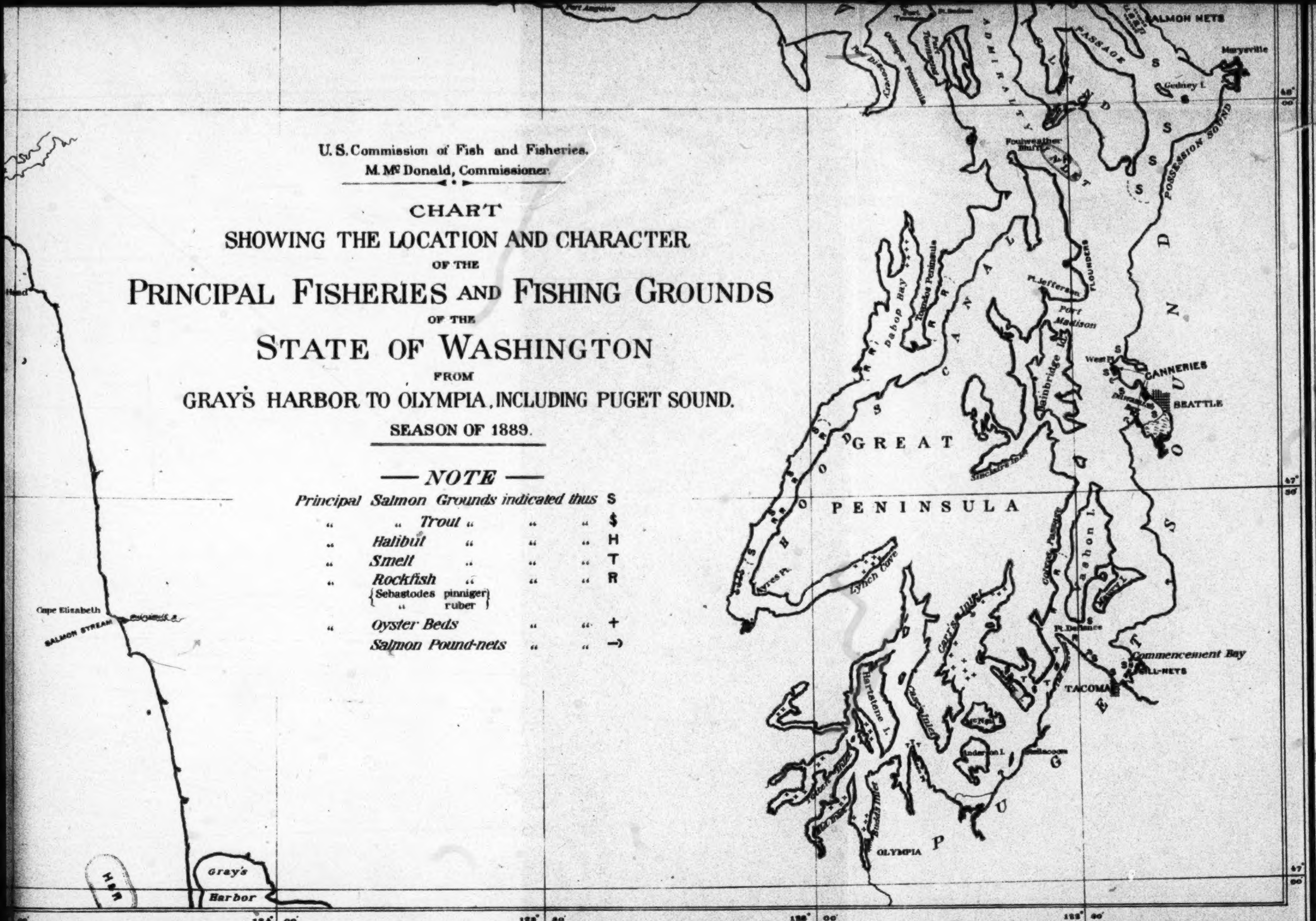
U. S. Commission of Fish and Fisheries.
M. McDonald, Commissioner.

CHART
SHOWING THE LOCATION AND CHARACTER
OF THE
PRINCIPAL FISHERIES AND FISHING GROUNDS
OF THE
STATE OF WASHINGTON
FROM
GRAY'S HARBOR TO OLYMPIA, INCLUDING PUGET SOUND.

SEASON OF 1889.

— NOTE —

Principal Salmon Grounds indicated thus S
" " *Trout* " " " $
" *Halibut* " " " H
" *Smelt* " " " T
" *Rockfish* " " " R
{Sebastodes pinniger}
{" ruber}
" *Oyster Beds* " " +
" *Salmon Pound-nets* " " –)



U. S. Commission of Fish and Fisheries.
M. McDonald, Commissioner.

CHART
SHOWING THE LOCATION AND CHARACTER
OF THE
PRINCIPAL FISHERIES AND FISHING GROUNDS
OF THE
STATE OF WASHINGTON
FROM
GRAY'S HARBOR TO OLYMPIA, INCLUDING PUGET SOUND.
SEASON OF 1889.

— *NOTE* —

Principal Salmon Grounds indicated thus S
" " *Trout* " " " $
" *Halibut* " " " H
" *Smelt* " " " T
" *Rockfish* " " " R
{Sebastodes pinniger}
{" ruber}
" *Oyster Beds* " " +
Salmon Pound-nets " " ⇀

Port Townsend
Pt. Hudson
Port Discovery
Quimper Peninsula
Port Townsend
ADMIRALTY INLET
PASSAGE
ISLAND
SALMON NETS
Marysville
Gedney I.
48° 00'
Foulweather Bluff
POSSESSION SOUND
FLOUNDERS
Pt. Jefferson
Port Madison
Dabop Bay
Toandos Peninsula
CANAL
HOODS CANAL
Bainbridge Id.
West Pt.
CANNERIES
SEATTLE
GREAT
PENINSULA
Sinclairs Inlet
SOUND
Lynch Cove
Colvos Passage
Vashon I.
Maury I.
Pt. Defiance
Commencement Bay
GILL-NETS
TACOMA
Carr's Inlet
Hartstene I.
Case Inlet
McNeil I.
Anderson I.
Steilacoom
Totten Inlet
Budd's Inlet
OLYMPIA
PUGET
47° 30'
47° 00'
Cape Elizabeth
SALMON STREAM
Gray's Harbor
124° 00'
123° 30'
123° 00'
122° 30'

Reservation, and, although attempts have been made to locate canneries on it, none but Indians are permitted to fish in the river; they catch a large quantity of salmon and prepare them for winter use. In 1888 there were about 300 men, women, and children on the reservation.

Sea otters were abundant near the mouth of the river in early days, but they have been hunted nearly to extermination.

49. FISHERIES OF THE QUILLIHUTE RIVER.

The Quillihute River is located in Clallam County within the limits of the Quillihute Indian Reserve. Its length is about 30 miles. There is a run of salmon from August to November, from which the Indians derive their principal article of food for the winter. In 1888 there was a population of 252 Indians living on the reservation. These Indians also engage in whaling during the summer; nine finback whales were captured in 1888; these were cut up and smoked for food. The catch is wholly for home consumption and has no commercial importance.

50. FISHERIES OF PUGET SOUND AND VICINITY, INCLUDING THE STRAIT OF JUAN DE FUCA.*

Geographical features.—From the standpoint of the fisheries, this region seems to have exceptional geographical advantages. The broad, deep Strait of Juan de Fuca, which separates the northwestern part of the State of Washington from Vancouver Island, affords an excellent entrance from the Pacific to Puget Sound and Washington Sound, as well as to the Gulf of Georgia, of which there is only a small portion within the boundary of the United States. At the western extremity of the strait, on the Washington side, is Cape Flattery; from this to near the entrance to Puget Sound the land is generally bold and high, with stretches of low, sandy beaches or long spits, but, except at Port Angeles, there are no fairly well-sheltered and safe harbors.

Puget Sound is one of the most remarkable waterways in the United States. Its deep and well-sheltered channels extend long distances inland, winding around many peninsulas and among numerous islands of greater or less extent (one of the latter being 30 or more miles in length), thus affording easy communication to an immense coast area. There is no lack of good harbors where fishing fleets may lie in safety, and also where curing and packing houses may be established whenever occasion calls for it. This region is comparatively near the Alaskan fishing grounds, and important halibut banks are in the vicinity. The towns on the sound are rapidly growing in population and importance, and considering the present transportation facilities and the probable extension of railroad communication in the near future, this is a specially favored region for prosecuting the sea fisheries of the Pacific. Indeed, Puget Sound, Washington Sound, and the Strait of Juan de Fuca are valuable fishing grounds, which will be referred to at greater length elsewhere.

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* Reference is made to the map, plate XLIII, for a clear understanding of this region, so far as the configuration of the coast and the extent of Puget Sound and adjacent waters are concerned.

The channels and harbors of Puget Sound are generally deep and unobstructed; but in some sections at the head of the sound, notably at Olympia, Commencement Bay, Nisqually Beach, and a few other places, the water is generally shallow, and in some cases navigation is impracticable near the shore except by small boats or flat light draft vessels. It is not uncommon for large areas of shallow flats to uncover at low tide. The land is much diversified in appearance. As a rule, it is high and broken, with ranges of mountains and several high peaks a short distance from the coast. Along the shores, however, are broad stretches of gently rising plateaus. The islands are generally rather low, but in many places the coast is fringed with low hills, varied by small valleys and frequently with steep headlands next the water.

Fishing centers.—The fishing centers of this region, mentioned in the order of their importance as such, are Seattle, Port Townsend, Tacoma, Neah Bay, Dungeness, and Olympia.

Seattle is a city of about 30,000 inhabitants. It is largely interested in maritime commerce, especially in the coal and lumber trade, and is the most important fishing center on Puget Sound. In 1888 it had a fishing fleet of six vessels (all schooners), with an aggregate tonnage of 426.36, engaged in pelagic sealing. Two schooners from Gloucester, Massachusetts (the *Mollie Adams* and the *Edward E. Webster*), which, in addition to pelagic sealing, were engaged a portion of each season in halibut fishing, made their headquarters here in 1888 and 1889. In the latter year a San Francisco vessel was chartered by Seattle parties and employed in the halibut fishery. In addition to sea fisheries, Seattle has important interests in the salmon industry. Besides the canning of salmon, it is the principal shipping point of the region for frozen salmon that are sent East by rail. The market fishery of Seattle is of much less consequence than might be expected, taking into consideration the advantages for catching fish, the growth of the city, and the facilities for shipments.

Port Townsend is a thriving town, with an estimated population of 5,000 or 6,000. It is situated near the junction of the Strait of Juan de Fuca with Puget Sound, and for this reason has been termed the "Key City." So far as the proximity of the sea-fishing grounds is concerned, it is somewhat more favorably situated than Seattle, but it lacks the railroad facilities of the latter, and is to that extent at a disadvantage as a fishing port. It has an excellent harbor, and doubtless will soon have railroad communication with the interior.

The fisheries of Port Townsend are yet confined to a limited amount of pelagic fur-sealing and some boat and shore fishing to supply the local market. In addition to this, one New England schooner (the

Oscar and Hattie, of Swampscott, Massachusetts), which engaged in the salt and fresh halibut fishery, made its headquarters there in 1889.

Tacoma is an important railroad terminus, of 25,000 inhabitants, situated about 20 miles south of Seattle, near the head of Puget Sound. It is largely interested in general commercial pursuits, among which lumber and shipping take precedence. The fishing interests are of considerable importance, and a large variety of fish is shipped from here to supply towns in the interior.

Neah Bay is located near Cape Flattery. Here there is an Indian reservation for the Makah tribe, which had a population of 484 in 1889. The Indians depend almost entirely upon the fisheries for a livelihood. Three small vessels, aggregating 80.57 tons, fished from Neah Bay in 1888, and there was another which was idle during that season, but employed the following year. All these were engaged in pelagic fur-sealing. The place is noted for the large number of dugout canoes employed in the fisheries, over 200 being owned there at the time Wilcox visited the bay. There are also curing houses, which will be referred to elsewhere.

Dungeness is located 17 miles west of Port Townsend; the harbor is poor and the place is of no great importance. A few Indians live in the vicinity and catch salmon chiefly for their own use. One small schooner of 49.62 tons made the place its headquarters while engaged in the fur-seal fishery in 1888.

Olympia, the capital of Washington, is at the head of steam navigation at the southern extremity of Puget Sound. It is chiefly engaged in manufacturing enterprises; its fishing interests are inconsiderable, consisting of clams dug for local use and a small oyster fishery.

Fishermen, factory hands, lay, etc.—A large majority of the fishermen are engaged in the coast or shore fishery. They are very cosmopolitan, representing eleven countries in addition to Indians. In 1888 there were 917 fishermen, of which 287 owed allegiance to the United States, in addition to 434 Indians of the Makah tribe. Among the white fishermen classed as citizens of the United States are those fishing from Puget Sound on vessels owned in New England, but which for the time being were a part of the fleets sailing from Seattle and Port Townsend. The personnel of the canning factories of Puget Sound is essentially the same as that on the Columbia River; a few white men are employed for superintendents, but the majority of the operatives are Chinese. Reference is made to the lay, wages, etc., under the heads of the different fisheries.

Species, abundance, seasons, etc.—Whales, chiefly the small sharp-head finner (*Balænoptera davidsoni* Scammon) are found off Cape Flattery and at the entrance of the Strait of Juan de Fuca, where the Indians improve every opportunity to capture them.

The fur seal (*Callorhinus ursinus* Linn.) is one of the most important objects of the fisheries of Puget Sound. It arrives off Cape Flattery in the spring, and is followed from there, in its migrations northward, until it reaches the waters of Bering Sea. The fur-sealing season was formerly from early in March (or possibly in February) until June; it is now continued much later. The sea otter is occasionally taken by the crews of the sealers.

Flounders of several varieties occur in the waters of Puget Sound and vicinity; they can be taken at all seasons, and constitute quite an important item in the fish trade at Seattle. The largest species is *P. stellatus* Girard, which is common and abundant in the vicinity of Cape Flattery and Neah Bay during summer. "The other varieties are known by the common names of large-eyed flounder, large-scaled flounder, hook-toothed flounder, long-finned flounder, short-finned flounder, bastard turbot, spine-cheeked turbot, black-tailed sole, black-dotted plaice, and other varieties of the small flounder family which are sold as sole. * * * They are very plentiful, and are readily taken with trawl nets, so that a supply can be had at any time."*

The halibut (*H. hippoglossus*) is, next to salmon, the most important species of fish in this section. During a large part of the summer season it is abundant in the vicinity of Cape Flattery, but frequently has to be sought at a more distant locality.

Cod (*Gadus morrhua*) and cultus-cod (*Ophiodon*), which is most commonly called "cod" here, occur in various parts of the sound and strait. They are reported to be most plentiful in February and March.

Herring occur at all seasons of the year, and are generally abundant. In a letter written to Professor Baird by J. P. Hammond and published in the American Angler, December 18, 1886, the following statement is made:

> From 1869 to 1877 it was not an uncommon occurrence for us to catch from 200 to 300 barrels of herring in a night, but since 1877 they have been growing less in number, until now the largest night's work is about 20 barrels.

The big red sculpin (*Scorpænichthys marmoratus*) is also called "rock-cod" by the fishermen. It occasionally attains a weight of 10 or 12 pounds, and is considered a good food-fish.

Rockfish of various species, mostly of the genus *Sebastichthys*, occur at all seasons. There are nearly the same varieties of rockfish here as at San Francisco, and they need not be discussed in this connection.

The black bass (*S. melanops*) is taken chiefly during July and August in the vicinity of Tacoma.

Perch (*Damalichthys*) and tomcod (*Microgadus*) occur at all seasons and are often abundant; but the latter species is not an object of capture.

Here, as at many other points on the Pacific coast, the salmon is the principal object of fishery. The following are the most important species taken in Puget Sound: Humpback (*O. gorbuscha*), silver (*O.*

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* James G. Swan, in Portland (Oregon) Journal of Commerce, November 15, 1884.

kisutch), and "jack" or "tyee" (*O. chouicha*), which is the quinnat or king salmon of California, and the Chinook of the Columbia. The red salmon (*O. nerka*), called the "sockeye" here, is the most abundant species at the northern part of this region, where also the steelhead occurs in small numbers, according to Mr. W. H. Kirby.

The jack salmon is the first to appear each season. It begins to run about the middle of August and remains in these waters until October, appearing singly or in schools. Its average weight is 11 pounds. It is stated that on some of the rivers of this region, particularly the Skagit, this species will average 20 pounds in weight, while the maximum often reaches 50 pounds.

The silver salmon does not arrive before September, and usually remains until about the first week in November. Its average weight is about 7½ pounds.

The humpback salmon, or "haddoh," is found from July 15 to August 15. This species is not very abundant, and is comparatively unimportant from a commercial standpoint.

The sockeye "run" is usually from early in July to September.

The dog salmon (*O. keta*) comes in the fall. It is not commercially important, for it has not yet been considered suitable for canning, and there is no market demand for it. But the Indians prefer it for drying, and depend almost entirely upon this species for their supply of salmon cured in this way. Other species, particularly the quinnat or "jack" salmon, are too fat for drying satisfactorily, and can not usually be dried whole like *O. keta*.

The presence of salmon in the sound is generally indicated by their jumping, but this does not always signify that they are numerous enough to warrant the use of a seine. The presence of large schools is more certainly determined by observing the fins showing above the water.*

Captain Tanner states that—

> A Mr. Herrick, formerly connected with a cannery on Columbia River, but now in the employ of Parker & Felters at Seattle, claims from an experience extending over the past 20 years that salmon are rapidly decreasing in this region. This decrease is due not only to the great annual catch, but also to the presence of much floating refuse from the sawmills of the neighborhood. Mr. Myers, of the Dwamish Head Cannery, on the contrary, considers that there has been no general decrease, and that there are no indications of the salmon becoming exterminated as some predict. He has been connected with the fishery in Puget Sound for the past 12 years, and states that salmon are as abundant now as at any time in the past. They fluctuate in abundance, however, from year to year. (*Albatross Explorations.*)

Smelt occur throughout the year, and are often very abundant.

A few shad are occasionally taken in Mud Bay, in the vicinity of Olympia, by the Tacoma fishermen. They were first noticed in Puget Sound in 1884, since which time they appear to have slowly increased in numbers, although the catch is yet unimportant, probably because no systematic efforts are made with proper apparatus. The fishermen in this region have undoubtedly been wise in refraining from making any special attempt to capture shad, since the species is thus afforded an opportunity to multiply, which it otherwise might be prevented from doing. They run in spring and summer. The average weight of those taken at Tacoma was 4¼ pounds, although individuals have been obtained which weighed 6¼ pounds.

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* When a school of salmon come near the surface, so that their fins can be seen, the fishermen say that they are "finning."

Salmon trout occur about the head of Puget Sound in the vicinity of Olympia. Off Johnson Point and near Tacoma are noted fishing grounds for them. Considerable quantities are taken for the market.

Sardines (*C. sagax*) occur here in the warmer part of the season, and are taken with herring and other species for market. An effort will probably soon be made to can sardines here as at San Francisco.

Dogfish (*S. acanthias*) are rather plentiful. A considerable number are taken for oil. Hammond claims, however, that this species "has become entirely extinct on some of the old fishing grounds, and on many others where a man with 500 hooks would take from 300 to 500 dogfish in a night he would not take that many in an entire season now."

The black-cod (*A. fimbria*) is said to be numerous in deep water in the Strait of Juan de Fuca. It is only obtained incidentally and is not an object of commercial fishery.

Crabs are not abundant but are taken to a moderate extent for local consumption. Shrimp are plentiful, but only a few are caught. Clams of several varieties occur at the head of the Sound, where they are taken in considerable quantities. There are four varieties of clams: *Schizothærus nuttalli;* giant clam, *Glycimeris generosa;* common round clam, *Tapes staminea;* and long clam, *Mya arenaria.*

Swan says that "the cockle, '*Cardium corbis*,' is very plentiful, and is dried by the Indians in great quantities for their winter use and to sell to the tribes of the interior." It may be said that at the present time the cockle is not of any commercial importance.

Native oysters occur most abundantly at the head of the Sound, in the coves, and on the flat, shallow reaches, many of which uncover at low tide. These are native beds. The oysters are small and dark-colored and have the characteristic coppery flavor.

THE MARKET FISHERIES.

The fisheries prosecuted from ports on Puget Sound for the purpose of supplying the inhabitants with fresh fish have not yet reached that state of development and importance that warrants a very lengthy discussion in these pages. As the coast cities and towns gradually pass from infancy into maturer years and become possessed of stable populations and more intimate relations with interior towns, the demand for fish food will no doubt become more and more pronounced, and efforts will then be directed towards the market fisheries. Up to the present time, however, the rapid growth of the Northwest has put such a premium on skilled and unskilled labor that there has been no necessity and little incentive for men to engage in the arduous and hazardous calling of fishing. Wilcox has observed that among the public buildings which spring up when a new town is established a good substantial fish market is usually not among them, and small shanties near the water's edge are generally the inauspicious pioneers of the market fisheries in all the settlements on Puget Sound.

Port Townsend is at most seasons fairly well supplied with fresh fish by a small fleet of sloop-rigged boats manned by about 40 persons. The species exposed for sale are mostly halibut, taken near the Strait of Fuca, and salmon, rockfish, black-cod, etc., secured in the waters of the Sound. The Indians at Neah Bay also contribute at times to the market supply of Port Townsend. The market fisheries of Seattle, although surpassing in extent those of all the other towns on the Sound combined, are not commensurate with other industries or the needs of the city. The principal varieties marketed fresh are rockfish, flounders, herring, perch, smelt, sardines, and salmon, of which about 1,150,000 pounds, valued at $42,000, were taken in 1888.

Tacoma represents about the southernmost point on the Sound from which market fishing is carried on and at which salt-water fish occur. Adjacent to the city, shad and salmon trout, in addition to the species already mentioned, are taken in pound nets, gill nets, and seines, operated from small sloops and open boats. The total catch in 1888 was over 850,000 pounds, worth to the fishermen $32,570. The market fisheries of this city are no doubt greatly promoted by a well-kept market with refrigerators, and by the abundance of ice used in preserving the properly dressed fish.

Market prices.—The following is a list of market prices for fishery products obtained at Tacoma, and these apply, with certain minor modifications, to other places on Puget Sound:

Species.	Unit.	Average prices.
Salmon	Pound	$0.08
Salmon trout	do	.06
Cod	do	.05
Rockfish	do	.08
Smelt	do	.08
Perch	do	.08
Halibut	do	.05
Shad	do	.25
Shrimp	do	.10
Crabs	Number (each)	.10
Clams	Sack (100 pounds)	1.00
Oysters	do	2.50
Oil	Gallon	.40

Fishing grounds.—Reference is made to the map, plate XLIII, for the location of the fishing grounds in this region. Halibut, cultus-cod, rockfish, and black-cod can be taken on numerous spots, indicated on the map, from off Cape Flattery and Cape Beall (Vancouver Island), in the Strait of Juan de Fuca and in Puget Sound.

Captain Tanner makes the following reference to the halibut grounds resorted to by vessels from Puget Sound ports:

> The nearest bank to Puget Sound, where halibut are abundant, is located off Cape Flattery at the mouth of the Straits of Fuca, and extends from close inshore to some 12 or 15 miles off the cape, in depths of water ranging from 35 to 75 fathoms. From early in the spring until the middle of June halibut can be obtained on these grounds in paying quantities, but later in the season dogfish and sharks strike in, driving nearly all the edible fish away. During the summer more northern localities would have to be resorted to. This information is based upon the statements of Capt. Silas Calder, commanding the schooner *Mollie Adams*, and at the time this region was examined by the *Albatross* the dogfish were found in full possession of all the important grounds.

Alexander thinks that the abundance of halibut, and the importance of the fishing grounds where this species can be taken have been overestimated. While he believes it possible that halibut may occasionally be found in great abundance, the researches of the *Albatross* have not led to the conclusion that they are generally very numerous. Scattering halibut were found about Middleton Island, the Shumagin Group, and Kodiak, but there was nothing to justify the belief that vessels could easily obtain fares at either of these places. The vessels engaged in the halibut fishery that have made their headquarters at Puget Sound ports have extended their cruises to more distant grounds, in many instances going as far as Alaska.

The principal grounds for salmon and rockfish are in Puget Sound and Washington Sound. The location is indicated on the map by the letters "S" and "R." The most important fishing grounds for trout and smelt are in the southern section of Puget Sound. The grounds resorted to for pelagic fur-sealing are the same as have been mentioned in connection with the fisheries of San Francisco.

It can scarcely be said that there are now any whaling grounds. Whales are rarely taken, and then only incidentally by the Indians and never for commercial purposes.

THE FUR-SEAL AND SEA-OTTER FISHERIES.

Among the sea-fishing enterprises carried on from Puget Sound, pelagic fur-sealing has attracted considerable attention of late, both because of the financial hazard involved (for few fisheries are more uncertain as to results) and the fact that vessels, catch, and all have sometimes been placed in jeopardy by the fishermen venturing to push their hunt into the waters of Bering Sea, from which they were excluded by law. Sometimes a "lucky" vessel has secured large returns for the capital invested and time employed, but quite as often the financial results have not been very profitable. However, the hope of being the "lucky one" tempts many to engage in the business from year to year; while others have followed this fishery so long that they have nothing better to do, and each season finds them starting out on a voyage as a matter of course.

Pelagic sealing has been carried on for some years from the Puget Sound region. As early as 1880 Swan records the fact that six schooners had been employed in seal fishing from Neah Bay during the previous year. These were the *Endora*, of San Francisco, and the *Champion*, *Teaser*, *Lottie*, *Letitia*, and *Mist*, of Port Townsend. The fishery has been prosecuted with varying fortunes since that time.

From the first the Makah Indians have been active participators in this industry, and that tribe furnishes some of the most skillful hunters employed in the business—men who have both an inherited and acquired knowledge of the pelagic habits and movements of fur seals. In recent years white men have entered more extensively into the seal hunt, and their numbers were materially augmented in the summers of 1888 and 1889, when the schooners *Mollie Adams*, *Edward E. Webster*, and *Henry Dennis* came here from New England, and brought large crews and an elaborate equipment of boats, etc., to engage in pelagic sealing. Although these vessels hailed from ports on the Atlantic, they really became a part of the fleet of this region, and have been so considered here. It would be interesting to trace in detail the history of this branch of the fishery, but its importance scarcely seems to demand it, and space will not permit it.

Vessels and boats.—With the exception of the before-mentioned New England schooners, the vessels employed in the seal fishery from Puget Sound and vicinity are small, roughly constructed, cheap craft, such as would scarcely command crews from many of the Atlantic ports.* It was stated before the Senate committee that vessels fitted out for the sealing business cost from $600 to $1,800, and $2,000 are required to fit one out. The vessels are all schooner-rigged and carry large crews and many boats. The boats are chiefly of two types, one introduced by the New England fishermen and the other a native dugout canoe.

Apparatus and methods of fishing.—The following account of the apparatus and methods employed by the Indians was prepared by Swan in 1880, and, with few minor changes, among which the use of firearms is the most noticeable, is said to be applicable to the present time:

> Until within a few years past the Indians have gone to sea boldly in their canoes, starting out at daybreak and returning at night. Three men usually go in a canoe at such times. Latterly they have put their canoes on board the sealing schooners which take them to the sealing grounds and lie by while the Indians go off in them and spear seals; the canoes taken on board the schooners had but two Indians in each.
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> The outfit of each canoe consists of one and sometimes two spears, which are fitted

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* Captain Joshua Brown testified before the Senate Committee on Relations with Canada (see page 344) as follows: "I have not seen a vessel here that you could get a crew upon from Gloucester to do the fishing. There is very little value to these soft-wood vessels. They are coarse and rough."

in the following manner: A pole 15 or 16 feet long, with a broad place at one end, on which the fingers are clasped, and fitted with two prongs at the other end, which are inserted into the sockets of two barbed spear-heads, each attached to a stout line either made fast to the pole near the middle or held in the hand of the spearsman. A club is also provided for knocking the seal on the head after he is speared; and two buoys made of the skin of the hair seal (*Phoca pealii* Gill), taken off whole and blown up with the hair side in. These buoys are used either to bend on to the spear line if the animal is not easily killed, or in case of rough weather they are attached to each side of the canoe a little forward of the center, and render her steady and seaworthy.

After a strong wind and the accompanying heavy sea have subsided, the seals lie on their backs in the water and sleep. Then the Indians cautiously and quietly approach them, and, selecting a victim, silently paddle near enough to thrust the spear deeply into its body, and at once withdrawing the pole leave the barbs imbedded in the flesh, sometimes killing it outright, but oftener only wounding it. The barbed spearhead, however, holds fast, the line is quickly hauled in and the seal knocked in the head with a club. They smash in every seal's head, whether it has been killed by the spear or not, and so universal is this practice that, although I have repeatedly offered to pay the Indians liberally for a perfect skull, I have been unable to procure a single specimen. The Indians here never use firearms to kill seals; they say the report would scare them away, and they strongly object to white men using rifles on the sealing grounds.

After the day's hunting is over, the canoes which have put off from the shore return with the seals they have taken, which are then skinned on the beach or in the lodges by the women. The canoes belonging to the schooners take their catch on board the vessels which at first brought them all ashore to be skinned, but this season they have been mostly skinned and salted on the schooners. Each vessel takes as many canoes as she can carry, the number varying according to the size of the vessel, from eight to fifteen being the average, although the largest vessels can take twenty, but very seldom exceed fifteen. The Indians pay one-third of their catch for having themselves and their canoes transported to the sealing grounds and back to Neah Bay.

These schooners have cabin accommodations for the officers and crews, and the Indians are assigned quarters in the hold among the salted skins, reeking carcasses, and blubber of the seals, for the Indians wish to save the blubber to make oil, and the carcasses to use for food, until they are too plentiful, when they are thrown overboard, or, if skinned on shore, left on the beach for the tide to remove.

The largest of the schooners have forecastle accomodations for some of the Indians, but the most of them sleep in the hold, where the peculiar odor of the seal skins and blubber seems to impart a healthy and invigorating influence on these savages, who appear to thrive and grow fat during the season.

The blubber taken from the seals is tried out by the women in the lodges; they cut it into small pieces, which they boil in iron pots and brass kettles. The oil when cold is put into various receptacles, generally into large pouches or bottles made from the paunches of seals, sea lions, or the killer (*Orca ater* Cope), which abounds in Fuca Strait. These pouches are first cleaned, then blown up full of wind and rolled and rubbed and stretched, and again and again blown up till they attain their utmost tension. They are then left to dry, in which condition they retain their shape and are serviceable in holding oil.

The cleanest and nicest oil is placed in these paunches and is used with their food as white people use sweet oil or butter, and when fresh is no more disagreeable than lard. Oil that gets scorched or dirty, or any surplus oil, is sold to the whites.*

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* From testimony taken by the Select Committee on Relations with Canada, Senate Report 1530, part 1, Fifty-first Congress, first session, page 272.

The apparatus and methods employed by the white seal-hunters are essentially the same as those referred to under the head of the fur-seal fishery from San Francisco.

Review of the fur-seal and sea-otter fisheries, 1888.—The following review of the pelagic seal and sea-otter fisheries prosecuted from the various ports of this region is arranged to show the interest of each place during the season of 1888. When the investigation closed upon which this report is based the season of 1889 was not completed.

The business of taking fur seals and sea otters was prosecuted from Dungeness, Seattle, Port Townsend, and Neah Bay in 1888.

One vessel, the schooner *Granger* (49.62 tons), engaged in pelagic fur-sealing from Dungeness. The vessel carried 3 white men and 18 Indians, in addition to 2 squaws employed in dressing the skins. Its outfit included 9 Indian canoes, and guns and spears. The result of the season's work was 510 sealskins, valued at $2,550. The lay, which differed somewhat from that in other fishing centers, was as follows: The Indians received $1.15 for each seal secured; the captain was paid a salary of $75 per month, and the other white men were also on salaries, at $40 per month.

Three vessels, aggregating 129.24 tons, made Port Townsend their headquarters while engaged in this fishery. One of these also devoted some attention to the pursuit of sea otters. The season's work resulted in the capture of 1,040 seals and 30 sea otters, valued at $5,825 and $3,450, respectively. The seal-hunters from this place received $2½ for each seal recovered, and the boat-pullers got 50 cents a pelt. The masters of the vessels were paid regular wages, and also a commission on the gross stock. The cooks got 50 cents a skin.

For a number of years a few small vessels have followed fur-sealing from Seattle with varying success. Recently larger vessels from Gloucester, Massachusetts, have entered into the business, and in 1888 the fleet consisted of 5 sail, with an aggregate tonnage of 341.45. The seals are all taken outside of Puget Sound, on the high seas. The vessels go south in the spring, and usually fall in with seals in the vicinity of the Farallone Islands. They then follow the animals as they migrate north. The season lasts from April to October, during which time, if fishing is good, vessels in this fishery will make several trips, landing their fares at Port Townsend, Seattle, or Victoria, refitting and again following the seals toward the north. The crews consist of 18 to 29 men, and are divided into boat-pullers and hunters, one man of each class going in a boat. The boat-pullers receive $25 a month and a bonus of 10 cents for each seal secured by the boats, while the hunters are paid $1.50 for each seal taken. White men constituting the crews use only guns in the capture of seals, while the Indians employ both guns and spears. One vessel, in 1888, was fitted out with three large gill nets for capturing seals; these had a total length of 350 fathoms, were 3 fathoms deep, and had a 10-inch mesh. The vessel lost 2 men. The nets were not considered a success, only 337 seals being secured, while the average catch of the other vessels of the fleet was over 550 seals. The total catch in 1888 was 2,551 seals, valued at $15,158.

Three vessels, with a total net tonnage of 80.56, made Neah Bay their home port while fur-sealing in 1888, and another vessel also engaged in the fishery the following year, but was seized for illegal sealing. The crews of the vessels from this place are almost entirely Indians, and the vessels are really owned by them, but a few white men are shipped to manage the craft and comply with the customs regulation requiring the master to be a citizen of the United States. There were 1,250 seals taken in 1888, yielding $5,925.

THE SALMON FISHERY.

Importance.—The salmon fishery is the most important one carried on in the waters of Puget Sound, and the catch amounts to more than a third of the entire yield of fish in this region. Salmon are taken in considerable quantities at Seattle, Port Townsend, and Tacoma; small quantities are also secured by the Indians of Neah Bay. The salmon fishery at Seattle is more prominent than that for all other species combined, and owes its importance to the canneries at or near that place.

Apparatus and methods of capture, yield, etc.—The salmon fishery is prosecuted with purse seines, pound nets, or trap nets, and a few gill nets. The Indians employ trolling hooks and spears in the Sound and small streams tributary thereto, and parties fishing for pleasure also use spoon hooks and trolling lines. In autumn, when salmon are most numerous in the sound, Seattle Bay is literally covered with pleasure boats for days in succession.

In the deep, swift waters of Puget and Washington Sounds the purse seine has been found the most effective form of apparatus yet used in the salmon fishery. It was first employed here in 1886, and its introduction is credited to the Chinese. It closely resembles the purse seine employed in the Atlantic fisheries, except that it is fitted with an apron that can be hauled under the bunt in pursing, a device which was first invented for the mackerel seine, though it has not, to my knowledge, been successfully applied in the mackerel fishery. All of the salmon seines, however, do not have this apron. Captain Tanner describes this apparatus as follows:

> These seines are 200 fathoms long, 25 fathoms deep in the bunt, and 90 fathoms in the wings; they have a 3-inch mesh. The twine used in their construction is of three sizes, Nos. 12, 15, and 18, No. 12 being used in the bunt, No. 15 at each side of the bunt, and No. 18 in the wings. The foot line is heavily leaded, and the bridles are about 10 feet long. One and one-half inch Russian hemp is used for the purse line. The rings through which the purse line is rove measure about 5 inches in diameter, and are made of small-sized galvanized iron.
>
> The Puget Sound fishermen claimed that this style of purse ring was superior to that used upon the mackerel seines of the eastern coast. They had given the mack-

> eral purse rings fair trial and were forced to abandon them, as the purse line would invariably draw twine into the rings, thereby preventing the pursing of the seine. Schools of salmon were often lost from this cause. A subsequent examination of some of the condemned "Gloucester rings," as they were called, showed them to be of the small composition make, such as were employed at one time on the "shoal" or small seines. This kind of ring has not been in use by the mackerel fishermen for 8 or 10 years, having been given up by them for the same reason explained above. There is no apparent reason why the modern mackerel purse ring would not work to advantage on the salmon purse seines of Puget Sound.
>
> The time is not far distant when the combination of Oriental ideas which now prevails in this region will give way to the modern improvements which the American fishermen are bringing with them to the Pacific coast. It will, however, probably take some time to overcome the prejudice which now exists against the introduction of new methods of fishing, as the Greek and Italian fishermen are very conservative and look with disfavor upon any change from the old ways.

A sharpy seine-boat and a scow are required for operating each seine. The former carries 5 men and the latter 4 men, this constituting the regular seine crew. The scow is about 20 feet long and 8 feet wide. It is fitted with an iron winch at each end, for pursing up the seine, and is deemed indispensable for operating a net of this kind. The seine is stowed upon the after part of the seine-boat, about 8 feet of which is decked over at the stern for this purpose. Captain Tanner says:

> The method of stowing and throwing the seine differs somewhat from that followed in the mackerel fishery. The salmon seine being thrown over the stern of the boat, it has to be stowed fore and aft instead of athwartship. The corks are placed on the port side, the twine on the starboard side. The twine is thrown in a heap, not arranged neatly in "flakes" and "bits" as upon a mackerel boat, because the man who throws is not particular to have it clear the stern so as not to retard the speed of the boat in going around a school. The result is that the oarsmen have an extra amount of work to perform.

He also gives the following interesting account of the method of fishing with a purse seine in Puget Sound:

> Starting upon a fishing trip, the boat, with its scow in tow, is rowed to a favorable locality where salmon are likely to occur, and, having anchored the scow, a lookout is kept for fish. As soon as a school is sighted the boat is shoved off, leaving one end of the seine attached to the scow. A circle is made around the fish, the boat returning again to the scow, when all hands jump aboard of it and commence to haul in on the twine and corks, two men standing at the winches and slowly taking in the slack on the purse line. It is not, however, until half the length of the seine has been pulled in that they begin to purse up in earnest. At this time the anchor rope is slacked off, and, all hands laying hold of the purse line, purse the scow into the middle of the seine. Were this done in the beginning much hard labor could be saved. Time and labor would also be economized by slacking the anchor rope while the first half of the seine is being hauled in, instead of which the seine is hauled bodily through the water.
>
> During the slow process of pursing a man stands at the davit with a long pole, having a block of wood called a "plunger" fastened to it. This is kept working up and down between the purse lines, for the purpose of frightening the fish away from the center of the net; and it is, no doubt, very effective in saving the school, as the bottom of the seine is left open from 25 to 40 minutes, which is ample time for a salmon to find its way out.

From an hour and a half to two hours are required for setting, pursing up, and stowing the seine ready for another trial. On two occasions, when the operations were timed, they consumed on an average 1 hour and 45 minutes.

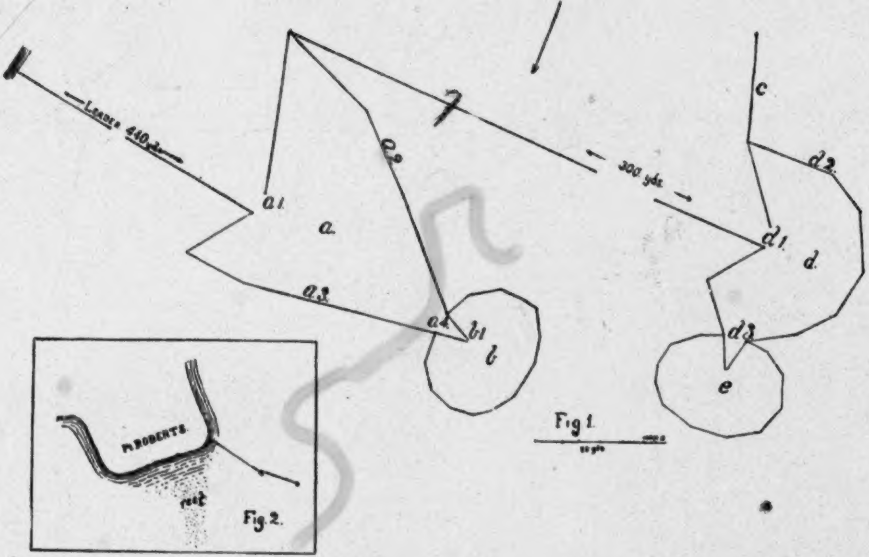
After the slack of the net is hauled in, so that the fish are "dried up," the salmon are taken out with gaffs and thrown into the well of the scow. Sometimes very large hauls are made with these seines on Puget Sound. For instance, in 1888, on October 28 and 29, two seines belonging to Mr. George T. Myers, of Seattle, fishing off Hat Island, took 28,000 salmon that weighed 210,000 pounds, or an average of 7½ pounds to each fish. At the first haul of one of the seines, at 4.30 a. m., October 28, 6,690 salmon were caught, and it was 11 o'clock a. m. before they were all removed with the gaffs. The other seine, set at the same time, had, by estimate, 10,000 fish; but, owing to the parting of the cork-line, only 3,500 were secured. These hauls were exceptionally large. Some idea can be formed of what is considered an average haul by a perusal of the following figures, kindly furnished by Mr. Myers from his books, each figure representing a single cast:

Number of salmon caught at single casts on the dates named.

Sept. 23, 1888, 7 seines.	Sept. 26, 1888, 6 seines.	Sept. 30, 1888, 6 seines.
45	83	401
126	998	43
1,495	553	129
1,193	505	1,545
453	124	1,065
403	128	56
163		
3,877	2,391	3,239

Seven pound nets and trap nets were used in the vicinity of Seattle in 1888. They are coming more into popular favor each year, and the number will doubtless be materially increased within a short while. Captain Tanner makes the following reference to these:

> There are seven fish traps in Puget Sound, all of which were put down during the spring of 1888. Four are owned by Parker & Felters, proprietors of the Columbia River Cannery at Seattle, who were the first to introduce traps in this locality. Mr. Felters is of the opinion that these appliances will take the place of seines, as there is less expense attendant upon their management. One or two men are sufficient to tend them and keep them in repair. The fishermen about Seattle are strongly opposed to the building of traps, as threatening the future prosperity of the salmon fishery if they are used to any great extent. With the general introduction of traps, requiring much fewer men to carry on the work, the majority of the present fishermen would be forced to seek other employment during the salmon season; and, furthermore, the fishery would soon be broken up, at least to such an extent as to make it unprofitable to more than a very limited number of fishermen.
>
> Up to September, 1888, the traps had taken a large proportion of the salmon brought to the Columbia River Cannery at Seattle. In addition to the traps, this cannery has also two drag and two purse seines fishing for it.


Leader 440 yds
a1
a.
a2
a3
a4
b1
b
300 yds
c
d2
d1
d.
d3
e
Fig 1.
Pt. ROBERTS.
reef
Fig. 2.

POINT ROBERTS POUND NETS.

FIG. 1. Diagram showing pound nets: *a*, heart of inner pound; *a1*, entrance to heart; *a2*, side of heart, 50 yards long; *a3*, side of heart, 40 yards long; *a4*, entrance to crib; *b*, crib; *b1*, funnel; *c*, wing to outer heart; *d*, heart of outer pound; *d1*, entrance; *d2*, side of heart; *d3*, funnel entrance to crib; *e*, outer crib.
FIG. 2. Location of pound net and reef at Point Roberts.

It is intended to introduce near Seattle a number of fish wheels, like those on the Columbia; they are to be located between some of the islands and worked by the tide.

At Port Townsend gill nets and lines are somewhat sparingly used in the capture of salmon. One vessel (the *Mary Parker*, a sealer) took 380 barrels of salt salmon, worth $2,660, in 1888, using trolling lines. The catch, in addition to the salt fish, consisted of only 10,000 pounds, valued at $450.

At Tacoma 3 seines, 4 pound nets, and about 50 set and drift gill nets were employed in 1888, taking 125,000 pounds of salmon, which were sold fresh for $3,750.

The Indians at Neah Bay use trolling lines, and in 1888 took 7,000 pounds of salmon, valued at $140. A much larger catch could, no doubt, be made at this place, were it not for the fact that the Indians, at the time of the salmon run, are chiefly engaged in hop-picking at places distant from their homes, having already laid in a supply of halibut and other fish to serve for their winter's food.

The aggregate yield of salmon on Puget Sound in 1888 was 1,930,250 pounds of fresh fish and 106,000 pounds of pickled salmon, valued at $41,095 and $3,410, respectively.

The following notes on special devices for fishing, etc., employed in the salmon fishery at Point Roberts have been furnished by Mr. H. B. Kirby:*

> In order that the difficulties and drawbacks which I have met with here in setting a trap net which will take salmon in clear water may be understood, the following notes concerning my experience in Puget Sound and the Gulf of Georgia are presented.
>
> It may first be stated that I was a fisherman on the Great Lakes for years before I came West. Soon after reaching Puget Sound I set a pound net in the same manner that they are fished on Lake Superior. This was a complete failure so far as taking salmon is concerned. I did not get over 100 salmon at a lift. Later I met with Lake Erie fishermen who had tried traps for salmon. They said there was too much phosphorescence in the salt water, and because of this salmon would not "lead well" into the pound or bowl.
>
> I fished five seasons for salmon with seines. During that time I devised a plan for a trap that I thought would catch fish in this region. This new pound net was set off Birch Bay Head, in the Gulf of Georgia, on March 15, 1888. It proved a complete success, and caught everything that was running at that time—all kinds of salmon, halibut, cod, flounders, dogfish, herring, smelt, anchovies, sea lions, hair seals, porpoises, sturgeon, ducks, loons, etc. The salmon running at that time were steelheads,

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*Point Roberts is close to the boundary line between British Columbia and Washington; it is the northernmost point on the American side from which salmon fishing is prosecuted in this section. These notes were embodied in a letter written to me in March, 1890; they have been somewhat modified for the purpose of adapting them to publication, but the original expressions of the writer have been retained so far as practicable. The notes contain much that is novel, interesting, and instructive, and constitute a valuable addition to our knowlege of the fisheries of this region. With his letter Mr. Kirby sent me some pencil diagrams of the traps at Point Roberts and the canoes fishing on the reef off that place. These have been redrawn, and furnish the illustrations on plates XLIV and XLV.

spring and jack salmon, and a few sockeyes [O. nerka]. This trap was set in 35 feet of water, and had a 900-foot leader. The diagrams of the traps set at Point Roberts in 1889 will show the form.

The little trap off Birch Bay Head worked so well that I determined to set a larger one at Point Roberts for the sockeye run, which begins about the 1st of July. This action was taken notwithstanding the late Captain Waller had been experimenting for 12 years with traps at the point for the purpose of taking the sockeye salmon, and had been successful only one season, when fish were so plentiful that there was no market for them. The stories of those who saw his trap fishing do not agree.

It may also be stated that Scotch salmon traps, set with buoys and anchors, Nova Scotia traps, and several other styles, are being tried here every season without success; in fact, they are total failures.

I had fished for sockeyes on the reef off Point Roberts the previous season, and thought my style of trap would work. The first one put down was set in 27 feet of water, and was so placed that it would take the fish before they went over the reef. It worked all right, except the tunnel. The fish would follow the leader and go into the hearts, but would not enter the pot. The water was very clear, and the bottom could be seen at low tide. I thought the tunnel was too small for clear water, though it worked well in March and April, when the wind was blowing most of the time and the water was muddy.

The run of salmon was very small that year; my catch was about 3,000 fish, which was not satisfactory. The next year (1889) I put in 740 yards of leader, with two sets of hearts and two pots [see diagram, plate XLIV]. But fish came so thick that more salmon were caught in one pot than could be taken care of; therefore the outside net was taken up.

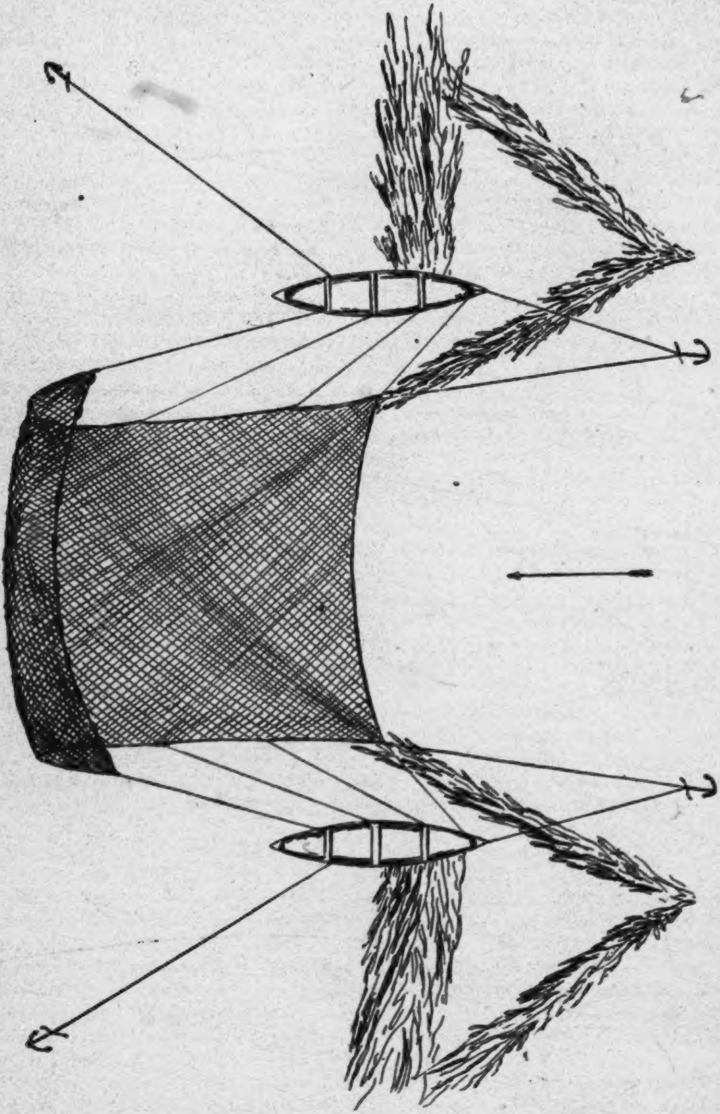
The salmon work into Boundary Bay on high water during the night and go over the reef on the ebb tide. When the run was the heaviest I would open the trap for 2 or 3 hours on the first of the long ebb and would take from 4,000 to 6,000 salmon. That being more fish than could be taken care of the traps were sometimes closed for 2 days. If the fish could have been taken care of it is probable that the catch would have averaged 10,000 salmon per day, which was quite an improvement on the results of the previous year. The only change made in the construction of the nets was that larger tunnels were put in.

The run began July 12 and continued until September 2. It was the heaviest and longest run of sockeyes known for years. With my traps and the reef nets there were about 150,000 sockeye salmon taken at Point Roberts for the season of 1889. The most of these fish went to the *Fraser River*; about 20,000 went to a small cannery on the American side, and some were salted. The average price paid by the canneries was 9 cents per fish.

A few Indians fish for sockeyes on Stuart Island; their catch was small and was salted.

The fall run of cohoes or silver salmon was very small (in 1889), both on Puget Sound and in the Gulf of Georgia. The catch in the gulf was about 50,000 fish that were canned and 160 barrels salted. I fished one trap 15 days for cohoes and caught about 4,000 salmon. I will remark here that the cohoes run in schools, and do not travel nearly so fast as sockeyes; consequently they can not be so readily taken with a trap net. I have known as many as 6,000 of this species to be taken at one haul with a purse seine. The sockeye salmon does not school after coming into the Gulf of Georgia, therefore it can not be taken in large numbers with a seine. It seems to be continually on the move. When fish of this species are reported opposite Victoria we expect them at Point Roberts in 3 or 4 days, though the places are separated a distance of 65 miles.

The principal drawbacks to trap-net fishing in salt water are the following: First, large quantities of floating seaweed drift into the nets and this has to be removed and carried to the shore in boats: second, hair seals, dogfish, and sturgeon frequently



SALMON-NET FISHING ON "THE REEF" AT POINT ROBERTS.
(Arrow indicates direction of current.)

geon use the traps and cause considerable injury to the twine. I have taken as many as 45 sturgeon at one lift, and they would weigh from 100 to 500 pounds each; third, cotton twine lasts a very short time when set in salt water.*

The salmon fishing on the reef, which extends outward from Point Roberts a distance of 2 miles, is mostly done by the Indians. About two-thirds of these fishermen come from British Columbia. In 1880 there were 16 nets operated on the reef. Each net consists of a piece of webbing about 30 by 40 feet, made of 32-thread cotton twine and having a mesh of 2½ inches. It is hung "on a third," with the exception of about 4 feet at one end, where it is taken up sufficiently in hanging to form a small bag at the top of the net.

Each fishing canoe has two places to fish on the reef, one for high water and one for low water; the object being to secure as nearly as possible a depth of water which does not exceed 8 feet.

Under natural conditions the reef is covered with kelp throughout its length, the kelp floating at the top of the water. A channel is cut through this, and in the passageway so prepared the net is set, and short leads of kelp are run out at angles from the opening so as to direct the fish into the net. The kelp is all submerged when the tide is running, but nevertheless has a tendency to lead the fish to the channel.

In operating the net two canoes are so anchored that they will be on opposite sides of the channel, and between them the net is held in position by an arrangement of guy lines. From the head anchor runs a double line, one part extending to the canoe and the other running to the net. What is termed a "side anchor" is placed a little astern, so that by hauling in on the line attached to it the net can be kept taut. As has been stated, there are a number of lines extending from each canoe to the net, and a small stone is bent on to the head anchor line close to the net, so that the latter will sink more quickly than it otherwise would.

The canoes lay side by side in the tide; the net is thrown over, the side lines are set up and spread out, the front of the net goes to the bottom, and the top or back is just under the water. The net is now set for fishing, although three sides of it are open so that fish can go out. Salmon are never meshed in this form of apparatus.

The oldest or best fisherman stands as lookout, and each of the crew has a line leading to the net. When the lookout has seen fish pass on to the net he gives the order to haul in on it, and the sooner the apparatus can be lifted the greater number of fish will be secured. When fish are thus seen the side lines are tripped and the canoes come together so that the net can be gathered up into a sort of bag. The fish are then rolled into the canoes, something after the manner of gathering up a seine, and as soon as the apparatus is emptied it is again thrown over and spread as before. It often happens that salmon are not seen until they have been on the net and have turned to go off. In such cases a water haul is generally the result.

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* Mr. Kirby has made an inquiry in this connection as to whether there is any preparation for the preservation of cotton twine which is better than coal tar. I will say that in the preparation of seines and other apparatus for the use of the U. S. Fish Commission I have had them both tarred and tanned. This method of preparation has been found very satisfactory, in that it has all the preservative qualities of coal tar when the net is set in the water, and the additional advantage that the twine is somewhat more flexible and not liable to spoil by heating when dried and packed in bulk. The Dutch method for preserving cotton twine used in the herring gill net is as follows: The tan is made by boiling catechu in water in the proportion of one pound of the former to two and a half gallons of the latter. When it is sufficiently strong the nets are soaked in it for 24 hours, after which they are dried. They are tanned and dried three times, and then soaked in linseed oil. A pound of oil is provided for each pound of net, and they are allowed to remain in it as long as any will be absorbed. They are then well drained and spread out on the ground to dry, after which the process is completed by tanning them once more.

J. W. COLLINS.

When fish are running in good numbers ten to fifteen Indians form a crew for a reef net, and a haul can be made every minute or two if necessary. Some of the Indians are very expert at this kind of fishing, and have taken as many as 2,000 salmon in a day. In such cases the clutchmen come out with canoes and boat the fish ashore so that the operations of those engaged in fishing will not be interrupted.

The origin of this style of fishing is attributed to one of the Hudson Bay Company's employés, who the Indians say taught them a long time ago how to catch salmon in this manner. At first, they state, their nets were made from the fiber of cedar bark. This style of reef fishing will never be profitable for white men, since it requires too many hands to operate the net, and there are so many days that fishing can not be prosecuted because of muddy water, strong tide rips, etc.

The long ebb and two-thirds of the flood tide run over the reef, and during the set of these tides is the right time for fishing, when the current is not swifter than 5 knots an hour. On high course tides, however, particularly when there is a strong wind blowing outside, the current often reaches a velocity of 8 knots, and reef fishing at such times is impracticable.

Salmon canning.—Although the waters of Puget Sound are capable of maintaining a large salmon fishery, the business of canning salmon has as yet reached only small proportions. Only four factories were located on the Sound in 1888, and all of these were in the vicinity of Seattle or controlled by Seattle parties. One located about 4 miles north of that city was burned in July, 1889; the precise location of the other canneries was, one at Seattle, one at West Seattle, and one at the mouth of the Skywamish River, about 75 miles due north of Seattle.

The 4 canneries were valued at $41,000 and had a cash capital of $68,000; they had 141 employés; 1,538,250 pounds of fish were utilized, with a value to the fishermen of $26,665; 21,975 cases were packed, valued at $126,356; and 150 barrels of salt salmon were prepared.

THE HALIBUT FISHERY.

The halibut fishery from Puget Sound and vicinity can be broadly classified under two heads, the vessel fishery and the shore market fishery. Such matters as relate to the fresh and salt halibut fishery, to the employment of Indians in the shore fishery, to the supplies of halibut obtained and cured by the Indians for their own use, etc., will appear incidentally in the discussion. But, for obvious reasons, most attention will be given here to the vessel fishery, which many hope may develop into a large commercial enterprise.

The vessel fishery.—The vessels, fishermen, boats, apparatus, and methods of capture employed in the vessel fishery were identical with those of New England, and the same system of sharing the proceeds, or "half lay," was observed as at eastern ports. These have been so fully discussed in previous publications of the Fish Commission (see vol. I, sec. V, Fisheries and Fishery Industries of the United States) that it seems unnecessary to refer to them at length here. It will suffice to say that the vessels ranged from 81.28 tons to 117 tons in size. They were some of the best New England clippers. The men had been trained in the

Atlantic fisheries, the boats were the ordinary bank dories, and the halibut were caught on trawl lines.

Narrative of the fishery.—The immediate cause of the attempt to inaugurate the halibut fishery from Puget Sound ports was the publication of a series of letters in the Cape Ann Advertiser, of Gloucester, Mass. The writer of these letters took a very optimistic view of the prospects for establishing a great halibut fishery on the Pacific similar to that prosecuted from Gloucester. The enterprising spirit characteristic of New England fishermen prompted them to consider the matter favorably, particularly as they knew from the most reliable sources that halibut were abundant off Cape Flattery at certain seasons. The pelagic fur-seal fishery was another strong inducement for the eastern fishermen to make the venture of sailing "around the Horn," for some believed that this offered unusual opportunities for financial success, while they thought the period between sealing seasons might be profitably utilized by engaging in halibut fishing. The men who entered upon this experiment were among the most skillful, daring, and adventurous of their class, and, so far as catching fish is concerned, none could be found better fitted for the work.

In the fall and early winter of 1887, three schooners sailed from Massachusetts for Puget Sound. These were the *Mollie Adams* and the *Edward E. Webster*, of Gloucester, and the *Oscar and Hattie*, of Swampscott. The two former were owned by Capt. Sol. Jacobs, who, after dispatching his vessels, crossed the continent in time to make necessary business arrangements pending their arrival. The *Mollie Adams* made a good passage and reached her destination without mishap; but the *Webster* met with an accident to her spars before rounding the Horn; put into Montevideo for repairs; was delayed, and finally arrived on the west coast late in the season. During the passage out her crew suffered from sickness.

The *Oscar and Hattie* reached Puget Sound some time later than the *Adams*, but in time to engage in the halibut fishery, upon which she entered, making her headquarters at Port Townsend. Owing to the want of a suitable market, and to the fact that the schooner had to go to Tacoma to ship her catch east, the fishery from this place was followed with loss rather than profit. The *Oscar and Hattie* carried 6 dories and a crew of 14 men.

About two-thirds of the catch was sold fresh and the remainder was salted. The result of the season's work in 1888 was 240,000 pounds of fresh and salt fish, with a value (at the prices paid the fishermen) of $7,600. The average price received for fresh halibut was 3 cents per pound, and for salt fish 3½ cents a pound.

Captain Tanner makes the following mention of one of her early trips for fresh halibut in 1888:

> A fare of 50,000 pounds of fresh halibut was recently taken to Tacoma, Washington, by the schooner *Oscar and Hattie*, this being the first cargo landed and shipped from

that port. The fish were taken in the vicinity of Cape Flattery. Little or nothing was realized from the trip. The ice cost $22.50 per ton, and high rates across the continent were charged by the Northern Pacific Railroad Company, over whose road the shipment was made. After discharging her cargo, the *Oscar and Hattie* proceeded to Port Townsend, where preparations were made for a second trip. An agreement was entered into with a firm at Vancouver to furnish the ice at $10 per ton, but three weeks passed without receiving any, and the schooner was forced to go north in the hope of obtaining a supply from the glaciers in southeastern Alaska.

During the winter of 1888–89 the *Oscar and Hattie* made a trip for salt halibut to Sitka and vicinity, Capt. Silas Calder in command. Captain Calder has had many years' experience in the Atlantic halibut fishery, and was well qualified for this undertaking. Nevertheless, the attempt to secure a fare of halibut in Alaska failed, and the result gives little encouragement to hope for success in winter fishing in that region.* Mr. Alexander had an interview with Captain Calder immediately after the latter's arrival at Port Townsend, and wrote as follows concerning it, under date of June 16, 1889:

> Captain Calder informs me that he fished every day that he could. From the 1st of January till the 1st of March they fished in the vicinity of Sitka and found nothing but red rock-cod.
>
> The weather was very blowy. They had no snow or ice to contend with, but high winds prevented their fishing a good deal of the time. From the 1st of March till within a week they fished off the southern end of Queen Charlotte Island, and managed by dint of very hard fishing to pick up 140,000 pounds. The last 3 weeks of their fishing they couldn't get enough to bait up their gear, and, in consequence of the scarcity of fish, only one skate of trawl to a dory was run. Now, last year, Captain Calder found excellent fishing in the same locality. Last season I was informed by him that he thought there would be no difficulty in catching from two to three salt trips a year, but according to his present statement of the halibut fisheries of Alaska the outlook is rather poor. This may be an exceptionally poor year. Another season halibut may be found more plentiful. It will take a series of years to speak knowingly of the Alaskan halibut fisheries.
>
> As soon as the spring months approach the halibut seek the shallow water of the numerous bays and channels. On inquiry as to whether it would pay to follow them into these bays, I was informed that they scatter too much to carry on fishing successfully.

From the foregoing it will be seen that the fare brought in by the *Oscar and Hattie* on this occasion was secured late in the voyage, after the vessel left Alaska.

The *Adams* and the *Webster* made their headquarters at Seattle. The latter did not arrive in time to engage in fishing during the summer of 1888, and the following year both vessels were employed a large part of their time in pelagic fur-sealing. During 1888, however, the *Adams* took 150,000 pounds of fresh halibut, valued at $4,500, and 180,000 of salt halibut worth $6,300.

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* On May 24, 1889, Capt. Joshua Brown, of Salem, testified before the Senate Committee on Relations with Canada (then at Tacoma) as follows: "You can not get halibut here in winter. I instructed my captain particularly to ascertain that fact, and he did."

Captain Tanner gives the following account of fresh-halibut fishing by the *Mollie Adams* in the summer of 1888, which shows the abundance of fish at that time:

> After disposing of her cargo of seals, the *Mollie Adams* at once refitted for the fresh-halibut fishery, and made four trips in quick succession, landing 145,000 pounds of halibut, the stock of which amounted to $3,000, the crew sharing $75 each. The expenses of the trips were high, however, $15 per ton being paid for ice on the first one, although on a subsequent trip it was obtained at $8 per ton, which was considered very low by the dealers. The high price demanded for ice is one of the chief obstacles to the development of the fresh-halibut business on the Pacific coast. Could this necessary article be obtained at reasonable figures, the western fishermen would stand a better chance of competing successfully with the eastern markets in supplying the fresh trade. The *Mollie Adams* landed her cargo at Seattle. * * *
>
> Capt. S. Jacobs and others interested in the fishery are seriously considering the expediency of building ice houses at Seattle, and making the attempt to cut ice for their own use the coming winter. It is stated that ice 6 inches thick was cut in the vicinity of Seattle during the winter of 1887–88. If this is true, however, it was an exceptional season, as many of the old residents in the region claim that the weather is never cold enough there to make ice over 3 inches thick. Should the effort to obtain the ice in Puget Sound prove unsuccessful, it is thought to be feasible to make use of large scows in bringing down supplies from the glacier region of Alaska. The expense of obtaining the ice by this method, including the cost of building and towing the scows and of cutting the ice, it is considered will be much less than by the present one.

Captain Tanner also makes the following statement concerning a fletched-halibut trip made by the same vessel:

> July 24 the schooner *Mollie Adams* left Seattle, bound north on a fletched-halibut trip, the first one of its kind that had been undertaken on the Pacific coast. But few halibut were captured until the schooner arrived off the southern extremity of the Queen Charlotte Islands, where they were found in great abundance and of larger size than on the grounds off Cape Flattery. A few of those taken were estimated to weigh over 300 pounds each. About half of the number obtained were large enough for fletching, the remainder being used as bait or thrown away. The trawls were not left down over night, the fish biting so rapidly that all the available time was occupied in caring for the day's catch. Only one cod was caught during the trip. Dogfish were numerous, but did not seem to interfere with the halibut taking the bait, as is the case at this season farther south.
>
> The fishing was carried on in depths of only 30 to 45 fathoms, so that the use of hurdy-gurdies was not resorted to. Halibut fishing in this region is very much easier than on the Grand Bank. Operations were continued without intermission until August 26, when a severe gale of wind sprang up from the southeast, lasting two days. The heavy sea produced by the storm caused the *Adams* to drag her anchor several times, but she finally "brought up" and rode out the gale without sustaining any damage or loss. This was the first time that this vessel had been tested at her anchor in a heavy sea, and her sea-going qualities were thoroughly established. From the experience of the *Adams* it is probable that fishing vessels would have no difficulty in making two or more fletched trips for halibut each season to the neighborhood of the Queen Charlotte Islands. Such trips made to Greenland and Iceland consume an entire season, and to this extent the fishermen of the western coast have an advantage over those of the eastern coast.
>
> On the morning of September 8 the *Adams*, having "wet" all her salt, started for home with 150,000 pounds of fish. Light winds prevailed during the passage of eight days to Seattle. Previous to the return of the *Adams*, her owner, Captain Jacobs,

had negotiated with the Northern Pacific Railroad Company to transport her cargo across the continent to Gloucester, Mass., at the rate of $1.25 per cwt. Immediately upon her arrival the rate was increased to $1.40 per cwt., which rendered it very doubtful if anything could be realized upon the trip; but the company was finally prevailed upon to return to its earlier figure, and the shipment was accordingly made. The cost of discharging, packing, and shipping the cargo amounted to $1,950. After deducting expenses the members of the crew received $175 each, or at the rate of $9 a day for 19 days' fishing.

Captain Jacobs is considering the expediency of converting the *Mollie Adams* into a steamer. Shorter passages to and from the grounds could be made under steam, especially during the summer when calms and light, variable winds prevail in this region. The amount of time that could be saved in that way would amply repay the cost of altering the vessel.

During 1889 a Seattle firm chartered a San Francisco vessel of 87 tons, and kept her constantly employed in halibut fishing during the summer. Her catch was landed at Seattle and sold locally or shipped to markets within easy reach.

Disposition of products, difficulties, etc.—The successful establishment of a fishing industry depends on the demand for the products, facilities for transportation, and the proper utilization of all available resources for placing the goods upon the market under the most favorable conditions, particularly if there is sharp competition. This applies with special force to the Pacific halibut fishery.

The comparative sparseness of population on the Pacific Slope, the fact that no proper effort had been made to introduce fresh halibut there as a desirable article of fish food, and that no attempt (at least no successful attempt) had been made on the west coast to smoke salt halibut, naturally compelled the fishermen to look to the East for a market. Thus, they had to ship, at great expense, cargoes of fresh halibut to New York, whence the products were distributed to various sections of the country, probably in some cases being sent west nearly half way back to the point from which they originally started. Some of the fish, particularly the earliest shipments, reached their destination in good condition and sold at remunerative prices. Other cargoes arrived on an overstocked market, and had to be disposed of at rates that gave unprofitable returns, while some shipments were not in good condition when they were received at New York, and proved a total loss to the fishermen.

The claim has been made that the financial results of these shipments were often, if not generally, unfavorably affected by a strong combination of Eastern fish-dealers, who, it was believed, manipulated the market so that the Pacific halibut should be placed at a disadvantage. This, added to the excessive freight charges for transportation across the continent, and other incidental expenses, practically placed it beyond the power of the fishermen to compete single-handed against the Atlantic halibut fishery, especially as the conditions for prosecuting the halibut fishery in the Pacific (except the abundance of fish) are less favorable than on the Atlantic. Captain Joshua Brown, owner of the schooner *Henry Dennis*, made the following allusion to these difficulties in his testimony before the Senate committee, already referred to (see pages 343, 344):

> What would be the use of catching halibut when they could not be brought to market? The transportation charge is so high to New York or Boston that it is impossible to ship these fish. They want about $700 for a car, and $10 a ton for ice, and the fish will shrink 2,000 pounds out of 20,000, and of course we get no drawbacks. We are charged 1½ cents a pound for the ice that is melted. Then, when we get to New York, we are boycotted and can not sell our fish, from the fact that the Atlantic Halibut Company have formed a trust. * * * Again, we can not come up to Seattle; it would cost us from $100 to $125 to tow to Seattle. There are so many calms, head winds, and heavy currents here in the summer season that sailing vessels can't do it. Perhaps it might do if there was a railroad from Seattle to Port Townsend. You can most always get west winds to Port Townsend and get up there, but the mountains make the winds here at Tacoma variable, and it takes sometimes 3 or 4 days to get up.
>
> * * * * * *
>
> The weather here is very unfavorable; it is either a calm or a gale of wind, and the wear and tear to vessels on this coast is from 25 to 30 per cent. more than it is on the Atlantic coast. The Pacific Ocean is never tranquil at all, and even in calms the vessel slaps and slaps, and there is such a continual motion that the ironwork wears out, and the sails wear out. * * * On the Atlantic when the wind is done blowing it is still, but on this ocean there is always a swell, and the vessel is always rolling.

The salt halibut has been shipped to Gloucester, Massachusetts, which is the headquarters of the smoked-halibut industry. The first shipment brought good prices and fairly remunerative returns. But the fish did not prove so desirable for smoking as those taken in the Atlantic, and subsequent consignments arrived in more or less bad condition, thus decreasing the demand. This, together with the high transportation charges and the difficulty of shipping salt halibut across the continent in summer (when it is liable to be overheated and spoiled), made it practically impossible to continue this branch of the fishery. At the close of 1889 the outlook for the continuance of the Pacific halibut fishery, as an industry of any considerable importance, was decidedly unfavorable; indeed, there was every prospect that it would be abandoned, or at least reduced to a scale only sufficient to supply the limited local demand.

From the foregoing the following conclusions may be drawn:

To insure the establishment of a successful halibut fishery on a permanent basis, it first seems necessary that there should be railroad communication with Port Townsend, or that steamers should be employed for fishing, and that the transportation agencies should realize the importance of making favorable rates in order to build up the business. The enterprise should also have the advantage of starting with ample capital backed by a knowledge of the business, and with an arrangement whereby the products—at least fresh halibut—can be distributed from some of the large cities of the Central States. The salt halibut should be smoked on Puget Sound. This would obviate the unnecessary expense incident to shipping fish to Atlantic ports, and would doubtless relieve the fishermen from much sharp competition they have heretofore met with. It is also quite certain that a judicious system of canvassing would lead to the utilization of moderately large quantities of halibut in the towns west of the Rocky Mountains, and a demand thus created would doubtless grow with the increase of population.

But while it is thus believed to be entirely practicable to build up a halibut fishery here of respectable proportions, it will probably be several years before such results are attained, and there are reasons for supposing that it will never rival the halibut fishery of the Atlantic.

Indian shore fishery.—At Neah Bay from 40 to 60 canoes are engaged in halibut fishing from June 15 to August 15. It is thought that perhaps 15 canoes are, on an average, constantly employed. The crews of the canoes number four or five men. About two fares are made each week, or about sixteen trips in a season. The principal fishing grounds are 10 to 15 miles northwest of Cape Flattery, but less important grounds, just out from Neah Bay, are also frequented. Although the catch varies from time to time, the average fare of a canoe is about 100 fish, with an average weight of 25 pounds each. Some halibut, however, weigh as much as 100 pounds. The aggregate annual yield of this fishery is 600,000 pounds, a small amount of which is marketed in Port Townsend and Victoria; but the bulk is dried or smoked and reserved by the Indians for use in the winter. It is said that the Makahs take more care and pains in drying halibut than in the preparation of any other article of food. It is cut into thin ribbon-like strips and carefully dried in the open air, if the weather is favorable; otherwise it is hung up in their "warm" (smoke) houses, and smoked until thoroughly cured. No salt is used on it.*

Their methods and apparatus, both for fishing and curing, are still nearly as primitive as they have been for centuries. They prefer hooks of their own make to those used by white men. Their fishing lines were formerly made of the fiber of cedar roots firmly twisted together, and rendered pliable and enduring by being skillfully roasted. Lines made of the giant kelp were also in favor, these being strong and flexible. Wilcox found that they now use cotton lines, as a rule. The hooks are large and clumsy in appearance, having a stout wooden shank, to which is fastened a shorter piece, at an angle of about 15°, by a stout seizing of cedar fiber at the point, and an iron barb is lashed to the shorter piece near its point. Steel hooks are occasionally used by Indians, who consider them inferior to those of their own make.

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*At Neah Bay two large "warm-houses" are utilized for residence purposes and for smoking fish, blubber, etc. These are barn-like structures, one of which is 66 feet long, and the other 99 feet long, 42 feet wide, 14 feet high on the walls, and 33 feet to the ridge pole. A smudge fire of driftwood is kept burning at each end of the building, and around this is a light lattice framework about 10 feet high, upon which are hung strips of fish and blubber for smoking. Along both sides of the building, for its entire length, are raised platforms, about 5 to 6 feet wide, and 1 foot high. These are covered with matting and skin robes of various kinds, upon which the Indians sleep or recline. In the center of the warm-house is an earthen floor that is frequently used for dances. When a dance is in progress the platforms at the sides are filled with men, women, and children, who are spectators, or not at that time participating in the dance. While these two houses are the most important of their kind at Neah Bay, there are many small smokehouses, all of which are called by the Indian name of warm-houses. The latter are separate from the cottages in which the Indians live.

THE OYSTER FISHERY.

Oysters occur in the headwaters of Puget Sound, and are taken for market only in the vicinity of Olympia and Tacoma, where the beds are exposed at low tide, and it is possible to drive teams directly to the shore and load the bivalves into wagons.

The principal beds, as located on the accompanying chart, to which reference is made, are in Lynch Cove, Dalop Bay, Totten, Eld, Budd's, and Carr's Inlets, and the strait west of Hartstene Island.

At Olympia the oyster business was of considerable importance in past years, but it has greatly declined of late. San Francisco, to which the bulk of the shipments was formerly made, now has large local beds on which it chiefly depends; and the trade with that place has been discontinued. The oyster beds in the vicinity of Olympia are of considerable size. They appear to be depreciating of late, however, owing to the disastrous inroads of starfish and the destructive effects of recent extremely cold weather. The beds are all exposed at low tide, and are worked only at that time. Teams are driven to the beds, and the oysters are gathered by hand, put in sacks, and hauled to the dealers for shipment.

The oysters are very small; the meat is dark in color and has a strong coppery taste. From 700 to 900 are required to fill an ordinary wooden bucket; these produce, when shucked, about one quart of solid meats.

Eighty-seven men, chiefly Indians, were more or less regularly engaged in this industry in 1888. The output amounted to 5,200 sacks of 100 pounds each, and was valued at $14,300, the average price being $2.75 per sack.

The local demand is not sufficient to utilize all the yield, and a considerable trade is carried on with Portland, Seattle, Tacoma, and other adjacent towns. In making shipments the oysters are placed in sacks, each holding six buckets of shell oysters.

The oyster industry of Tacoma is of less extent than that of Olympia. The output in 1888 was 2,700 sacks of 100 pounds each, worth $6,750, or $2.50 per sack.

The combined fishery interests of the various centers on Puget Sound are shown in the tables on the following page, covering the year 1888.

Table of persons employed.

How engaged.	No.
Vessel fisheries	270
Shore fisheries	647
Canneries	141
Total	1,058

Table of nationality and nativity of persons employed.

Country.	Nationality.				Nativity.			
	Vessel fisheries.	Shore fisheries.	Canneries.	Total.	Vessel fisheries.	Shore fisheries.	Canneries.	Total.
United States	93	194	16	303	76	86	16	178
United States (Indians)	135	299		434	135	299		434
British Provinces	11		2	13	11		2	13
South America		6		6		6		6
Germany						1		1
Italy		45		45		48		48
Portugal	2	14		16	3	34		37
Greece		7		7		7		7
Norway	9	25		34	15	44		59
Sweden	15	42	6	63	30	96	6	132
Russia		15		15		25		25
Japan	5			5	5			5
China			117	117			117	117
Total	270	647	141	1,058	270	647	141	1,058

Table of apparatus and capital.

Designation.	No.	Value.
Vessels (tonnage, [illegible])	14	$54,000
Outfit		29,[illegible]
Boats	414	32,000
Apparatus of capture:		
Seines	36	13,[illegible]
Pound nets and trap nets	12	8,[illegible]
Gill nets	97	19,[illegible]
Trawl lines, hand lines, and trolling lines		3,970
Shore property		46,000
Cash capital		68,[illegible]
Total		2[illegible],720

Table of products.

Species.	Quantity.	Value.	Species.	Quantity.	Value.
Fish.			*Mammals.*		
Cod, fresh ......pounds	220,400	$10,[illegible]	Fur-seal pelts ...number	5,[illegible]	$[illegible]
Halibut, fresh ......do	*[illegible],000	21,[illegible]	Sea-otter pelts ......do	[illegible]	2,[illegible]
Halibut, salted ......do	[illegible],000	10,100	Total	5,[illegible]	12,[illegible]
Flounders, fresh ......do	175,000	4,375	*Mollusks, crustaceans, etc.*		
Herring, fresh ......do	[illegible],000	2,000	Crabs ......number	7,[illegible]	[illegible]
Perch, fresh ......do	158,000	3,575	Shrimp ......pounds	5,000	[illegible]
Rockfish, fresh ......do	[illegible],000	6,[illegible]	Clams ......pounds, gross	[illegible],000	2,[illegible]
Salmon, fresh ......do	1,[illegible],250	41,066	Oysters ......do	[illegible],000	22,[illegible]
Salmon, salted ......do	106,000	3,410	Dogfish oil ......gallons	12,000	4,[illegible]
Smelt, fresh ......do	[illegible],000	11,[illegible]	Total		2[illegible]
Shad, fresh ......do	200	50	Grand total		1[illegible]
Salmon trout, fresh ......do	50,000	4,[illegible]			
[illegible], fresh ......do	[illegible],000	1,[illegible]			
Total	4,[illegible],[illegible]	1[illegible],810			

* Including the quantities sold fresh and cured by Indians.

SYNOPSIS.

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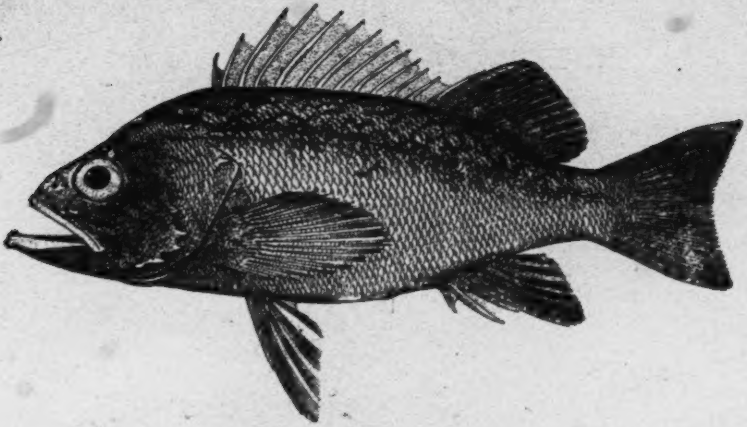
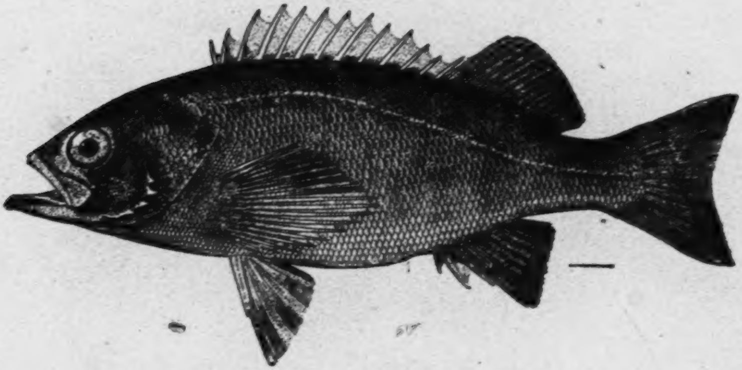
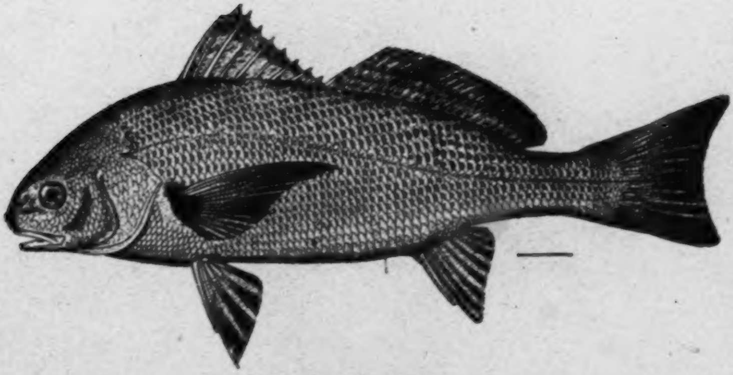


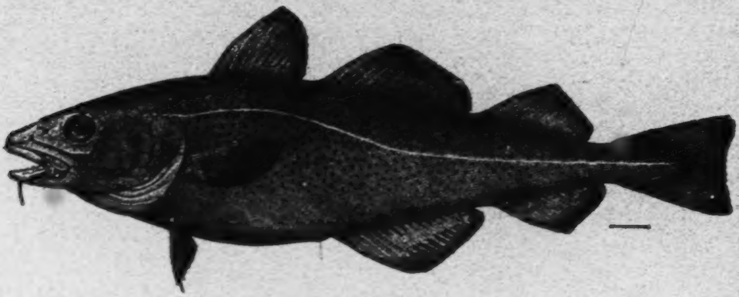
ORANGE ROCKFISH (*Sebastichthys pinniger*).



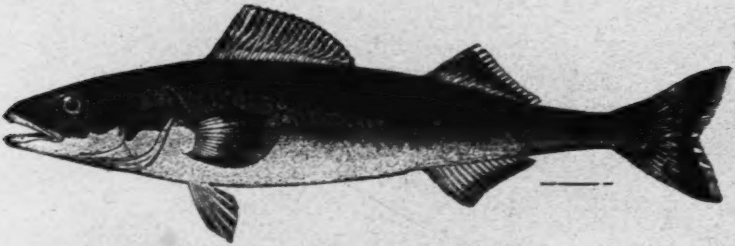
BLACK ROCKFISH (*Sebastichthys mystinus*).



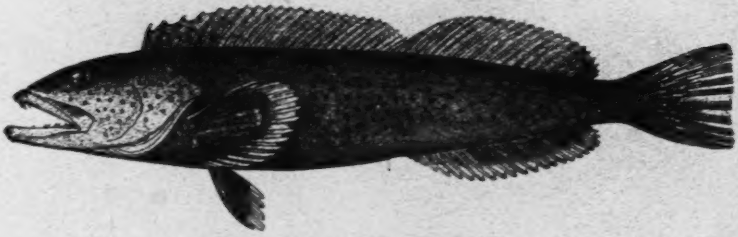
RONCADOR (*Roncador stearnsi*).



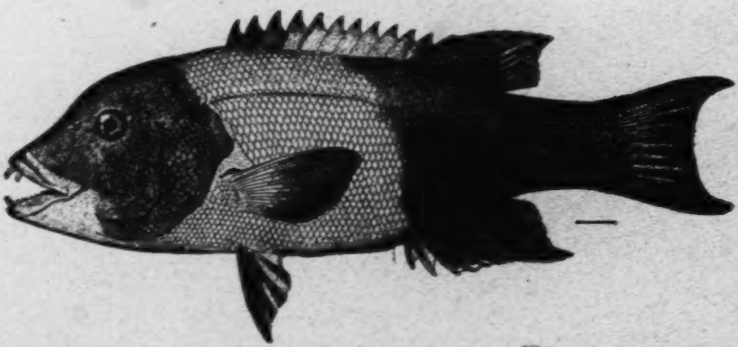
THE COD (*Gadus morrhua*).



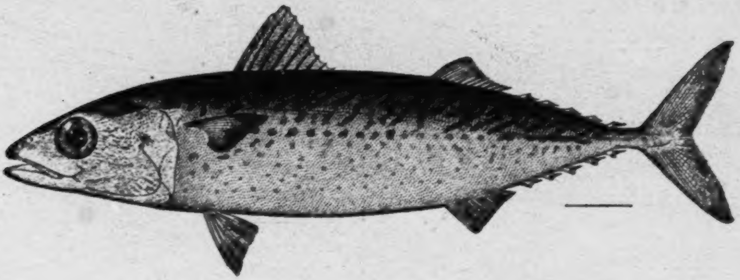
BESHOWE OR BLACK COD (*Anoplopoma fimbria*).



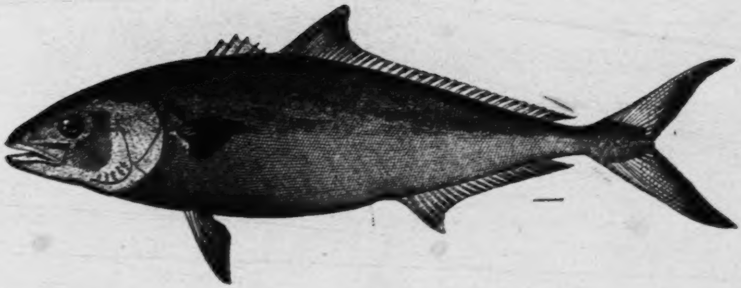
CULTUS COD (*Ophiodon elongatus*).



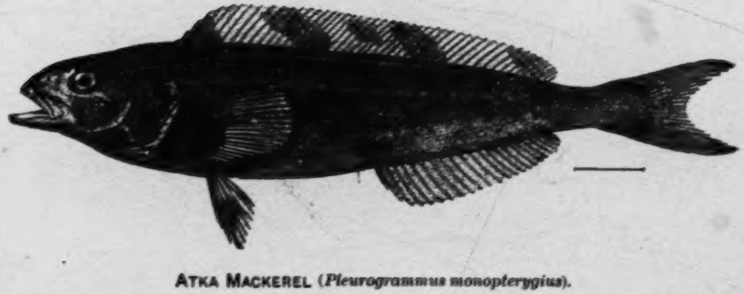
FAT-HEAD OR REDFISH (*Trochocopus pul[illegible]*).



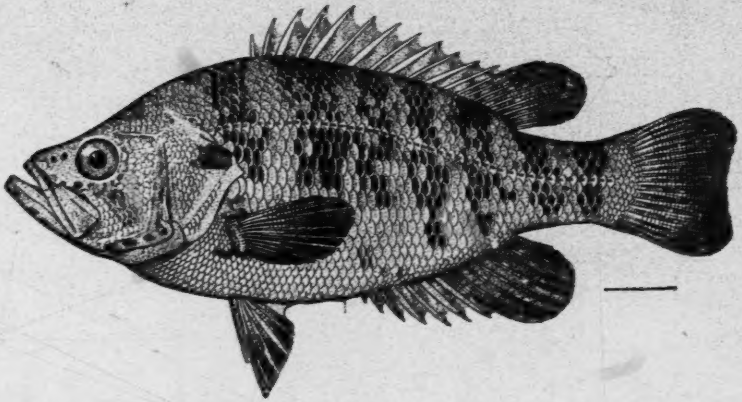
BULL'S-EYE MACKEREL (*Scomber colias*).



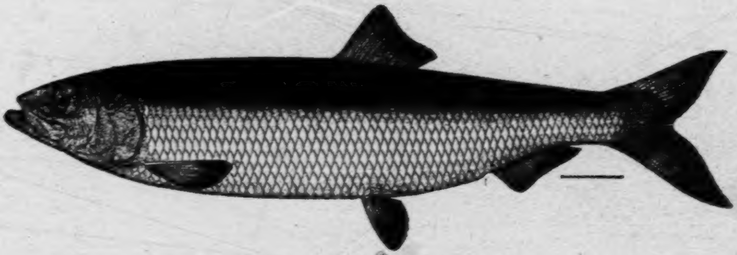
YELLOW-TAIL (*Seriola dorsalis*).



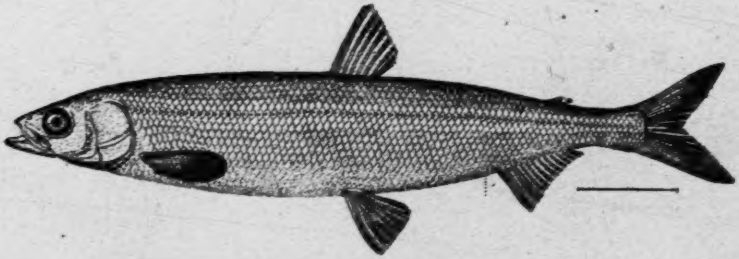
ATKA MACKEREL (*Pleurogrammus monopterygius*).



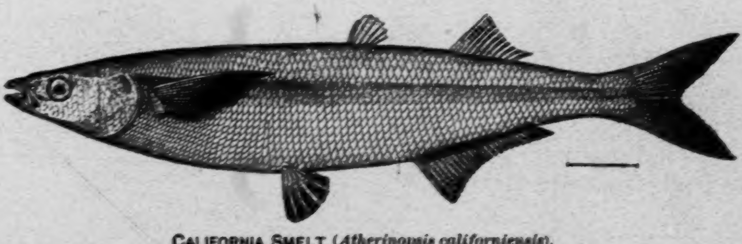
SACRAMENTO PERCH (*Archoplites interruptus*).



CALIFORNIA HERRING (*Clupea mirabilis*).



SURF SMELT (*Hypomesus pretiosus*).



CALIFORNIA SMELT (*Atherinopsis californiensis*).